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Data for a Heating Engineer's Handbook

COMPILED BY GERARD W. STANTON

[*The author, in the course of his work as a designing and constructing engineer, found it necessary, for accuracy and saving of time and labor, to tabulate such data as were proven by knowledge and experience to be correct. These tables are the result of this need, and will be found of service to all engaged in the design of heating and ventilating apparatus, if used with care and judgment.*—ED.]

I.

Methods of Figuring Radiation

The following tables for the figuring of radiation have been carefully worked out and have been used for years for many installations and with successful results for all sorts of conditions. In some cases, such as, for instance, the heating of school-houses and hospitals, where sufficient direct radiation is placed in the rooms to counteract the heat losses through

Method of Figuring Radiation by Wolff's Rule

1

Square feet of glass x factor Table 1 = heat units emitted per hour.
Square feet of wall (less glass) x factor Table 1 = heat units emitted per hour.
Square feet of door x factor Table 1 = heat units emitted per hour.
Square feet of skylights x factor Table 1 = heat units emitted per hour.
Square feet of floor x factor Table 1 = heat units emitted per hour.
Square feet of ceiling x factor Table 1 = heat units emitted per hour.
Square feet of roof x factor Table 1 = heat units emitted per hour.
Cubic contents x number of changes per hour x factor Table 3 = heat units emitted per hour.

2

Total heat units required per hour divided by heat units emitted per degree difference (see Table 2) = square feet of radiation.

3

The radiation is to be increased as follows:

10% where the exposure is a northerly one and the winds are to be counted on as important factors.

1% when the building is heated during the daytime only, and the location is not an exposed one.

3% when the building is heated during the daytime only, and the location of the building is exposed.

5% when the building is heated during the winter months intermittently, with long intervals (say days or weeks) of non-heating.

For coils multiply the total in cast-iron radiation by 0.85.

Cast-iron radiation, 1.7 heat units emitted per hour per degree difference.

Wrought-iron coil radiation, 2 heat units emitted per hour per degree difference.

TABLE I. H.U. EMITTED PER DEGREE DIFFERENCE OF TEMPERATURE BY WOLFF

DEGREE DIFFERENCE IN TEMPERATURE	VAULT LIGHT	SINGLE WINDOW	SINGLE SKYLIGHT	4 INCH WALL	DOUBLE SKYLIGHT	DOOR 65% WOOD 35% GLASS	8 INCH WALL	PLAIN DOOR	12 INCH WALL	16 INCH WALL	20 INCH WALL	24 INCH WALL	28 INCH WALL	32 INCH CEILING	36 INCH WALL	FLOOR	40 INCH WALL
5	6	5	5	3	3	3	3	2	2	2	1	1	1	1	1	1	3/4
10	14	12	10	7	6	6	5	4	3	3	2	2	1.5	2	1.5	1.5	1
15	20	18	15	9	9	9	7	6	5	4	3	3	2	2.5	2	2	1.5
20	28	23	20	13	11	11	9	8	6	5	4	4	3	3	3	3	2
25	36	30	25	16	15	14	11	10	8	6	5	5	4	3.5	3.5	3.5	3
30	43	36	30	19	18	17	14	12	9	8	7	6	5	4	4	4	3.5
35	50	43	36	23	21	20	16	14	11	9	8	7	6	5	4.5	5	4
40	57	48	41	26	24	22	18	16	13	10	9	8	7	6	5	5.5	4.5
45	66	55	46	29	27	25	20	18	14	11	10	9	7.5	6.5	6	6	5
50	72	61	52	32	30	28	23	20	16	13	11	10	8	7	6.5	7.5	5.5
55	80	68	57	36	34	31	25	22	18	14	12	11	9	8	7	8	6
60	86	73	63	39	37	34	27	24	19	15	13	12	10	8.5	8	8.5	6.5
65	94	80	67	42	40	37	29	26	20	17	14	13	11	9	8.5	9	7
70	100	86	73	46	43	40	32	28	22	18	16	14	12	10	9	10	8
75	108	92	78	49	46	43	34	31	24	19	17	15	13	11	10	10.5	8.5
80	115	98	83	52	49	45	36	33	25	21	18	16	14	11.5	10.5	11.5	9
85	122	104	88	55	52	48	38	35	27	22	19	17	15	12	11	12	9.5
90	130	110	94	59	55	51	41	37	28	23	20	18	16	13	12	13	10
95	138	116	99	62	58	54	43	39	30	25	21	19	17	13.5	12.5	13.5	10.5
100	145	123	105	66	62	57	46	41	31	26	23	20	18	14	13	14	12

TABLE II. HEAT UNITS EMITTED PER HOUR PER SQ. FT. OF CAST IRON RADIATION PER DEGREE DIFFERENCE OF TEMPERATURE.

STEAM PRESSURE	TEMP. T.	DEGREES DIFFERENCE OF TEMPERATURE BETWEEN HEATING MEDIUM and ROOM												
		40	45	50	55	60	65	70	75	80	85	90	95	100
40	287°	420	412	402	395	386	378	370	360	352	344	335	327	318
30	275	400	391	383	375	365	357	349	340	332	323	315	301	298
25	267	386	378	369	360	352	347	335	327	318	310	301	293	284
20	259	373	364	356	347	339	330	321	313	305	296	288	279	271
15	250	357	349	340	332	323	315	306	298	289	281	272	264	255
10	240	340	332	323	315	306	298	289	281	272	264	255	247	238
5	227	318	310	301	292	284	276	267	259	250	241	233	225	216
0	212	292	284	276	267	255	250	241	233	225	216	204	198	191
IN. VACUUM 5½	200	272	264	255	247	238	230	221	213	204	196	187	177	170
10	190	255	247	238	230	221	213	204	196	187	177	170	162	153
13	180	238	230	221	213	204	196	187	177	170	162	153	145	136
18	170	221	213	204	196	181	177	170	162	153	145	136	128	119
19	160	204	196	187	177	170	162	153	145	136	128	119	110	102
21	150	187	177	170	162	153	145	136	128	119	110	102	94	85

$(T-t) \times 1.7$

t = TEMPERATURE of STEAM OR WATER

T = " TO WHICH ROOM IS TO BE HEATED

1.7 = HEAT UNITS EMITTED BY CAST IRON RADIATION PER DEGREE DIFF. OF TEMPERATURE.

FOR COILS MULTIPLY RESULTS BY .85

TABLE III. HEAT UNITS PER CU. FT. OF AIR HOUR PER DEGREES DIFFERENCE OF TEMPERATURE

DEG. DIFF.	30	35	40	45	50	55	60	65	70	75	80	
H.U.	.596	.695	.795	.894	.993	1.09	1.192	1.291	1.391	1.49	1.589	
DEG. DIFF.		85	90	95	100	110	120	130	140	150	160	170
H.U.		1.689	1.788	1.887	1.987	2.185	2.384	2.583	2.782	2.98	3.179	3.378

$.0864 \times .23 \times (T-t)$ = FACTOR.

.0864 = WGT. 1 CU. FT. AIR AT ZERO

.23 = H.U. REQ. TO HEAT 1 CU. FT. AIR 1 DEG.

t = TEMPERATURE OUTSIDE AIR

T = " ROOM

RULE FOR FIGURING RADIATION

1 SQ. FT. GLASS WILL COOL 75 CU. FT. OF AIR 1° PER HOUR FOR EACH DEGREE OF DIFFERENCE BETWEEN EXTERNAL AND INTERNAL TEMPERATURES

10 SQ. FT. WALL 10"-12" THICK EQUAL 1 SQ. FT. GLASS
15 " " " 14"-26" " " 1 " " "
20 " " " 28"-38" " " 1 " " "

THEN $\left[\left(G+\frac{W}{10}\right)75+C\right]$ FACTOR = RADIATION

G- EQUALS SQ. FT. GLASS SURFACE
W- " " EXPOSED WALL LESS GLASS
C- " CU. CONTENTS × NO. AIR CHANGE PER HR

ADD 10% TO NORTH AND WEST EXPOSURES
" 15% " ALL BATH ROOMS IN ADDITION TO THE ABOVE—
FACTOR FIGURED ON A BASIS OF 1.7 H.U. EMITTED PER DEGREE DIFFERENCE OF TEMPERATURE—

FACTORS FOR CAST IRON RADIATION

STEAM PRESS. LBS.	TEMP. STEAM OR WATER	DEGREES DIFFERENCE TEMPERATURE BETWEEN ROOM AND EXTERNAL AIR →												
		40	45	50	55	60	65	70	75	80	85	90	95	100
40	287	.0019	.00192	.0025	.0028	.0031	.0034	.0038	.0042	.0045	.0049	.0054	.0058	.0063
30	275	.0020	.002	.0026	.0029	.0033	.0036	.004	.0044	.0048	.0053	.0057	.0062	.0067
25	267	.00205	.0021	.0027	.0030	.0034	.0037	.0042	.0046	.005	.0055	.006	.0065	.007
20	259	.0021	.0022	.0028	.0032	.0035	.0039	.0044	.0048	.0052	.0057	.0062	.0068	.0074
15	250	.0022	.0023	.0029	.0033	.0037	.0041	.0046	.005	.0055	.006	.0066	.0072	.0078
10	240	.0023	.0024	.0031	.0035	.0038	.0043	.0048	.0053	.0059	.0064	.007	.0077	.0084
5	227	.0025	.0026	.0033	.0037	.0042	.0047	.0052	.0058	.0064	.007	.0077	.0084	.0093
0	212	.0027	.0028	.0036	.0042	.0047	.0052	.0058	.0065	.0071	.0078	.0086	.0095	.01
IN. VACUUM 5/32 M.	200	.0029	.003	.0039	.0045	.005	.0056	.0063	.0070	.0077	.0086	.0096	.01	.012
10	190	.0031	.0032	.0042	.0048	.0054	.0061	.0067	.0076	.0085	.0096	.01	.012	.013
13	180	.0033	.0035	.0045	.0051	.0058	.0066	.0075	.0084	.0094	.01	.012	.013	.015
18	170	.0036	.0037	.0049	.0056	.0066	.0073	.0082	.0092	.01	.012	.013	.015	.017
19	160	.0039	.0041	.0053	.0062	.007	.0080	.0091	.01	.012	.013	.015	.017	.019
21	150	.0043	.0045	.0059	.0067	.0078	.0089	.010	.012	.013	.015	.017	.02	.024

FOR COIL MULTIPLY THE RADIATION BY .85

Nason's Rule
Approximate number of Cu. Ft. of Space 1 Sq. Ft. of Radiation will Heat.

Class of Radiation	Dwellings, Schools Offices Etc	Stores, Halls, Factories Etc.	Churches, Auditoriums Etc.
Direct Steam	60 - 80 Cu.Ft.	75 - 100 Cu.Ft.	150 - 200 Cu.Ft.
Indirect "	40 - 50 " "	50 - 70 " "	100 - 140 " "
High Temp. Water	50 - 70 " "	65 - 90 " "	130 - 180 " "
Low " "	30 - 50 " "	35 - 65 " "	70 - 130 " "
High Temp. Water Indirect	30 - 60 " "	35 - 75 " "	70 - 150 " "
Low Temp. Water Indirect	20 - 40 " "	25 - 50 " "	50 - 100 " "

windows and walls, and tempered air forced in for ventilation, it is possible to figure exactly the amount of radiation both direct and indirect required.

But where direct radiation only is installed, then judgment must be used, as that is the only way to determine the air leakage, or, in other words, the number of air changes per hour. These tables are especially valuable in designing heating systems for large halls and buildings of great air leakage or for forced ventilation.

Table I gives the heat losses through windows, walls, etc., with varying degrees difference between the outdoor temperature and the temperature desired in the room to be heated.

Table III gives the number of heat units per hour required to raise one cubic foot of air the number of degrees desired.

Table II gives the number of heat units emitted from one square foot of radiation, with different temperatures of the heating medium, and the temperature of the room desired.

Example.—A room 15 ft. x 20 ft. x 12 ft., two sides exposed; 3 windows 3 ft. x 7 ft.; 1½ air changes per hour. Outside temperature, zero; temperature of room, 70°; heated by steam at atmospheric pressure.

Then Glass 3×3×7=63 sq. ft. ×86=5418
13-in. wall 420—63=357×22=7854
Air change 3600×1½×1.391=7511.4

20783.4

20783.4÷241= 86 sq. ft. radiation
Add for north and west 10%..... 8.6

94.6 sq. ft. radiation

Table IV is another method of figuring radiation, being similar to formula A, recently submitted by the committee appointed by the American Society of Heating and Ventilating Engineers to gather the best data for the figuring of radiation, mains, etc. This table has been used a great deal, especially for buildings with small rooms, and with great success. The advantage of this table over formula A is that the factors for different temperatures, both of the room and of the heating medium, are worked out, thus enabling one to comply with any condition without adding any assumed percentage or by proportion.

In dealing with the density of gases, we must not overlook the importance of the varying changes brought about by moisture. The density of the air varies with respect to the amount of moisture it contains. The density of a mixture of gases will be equal to the mean of its constituents, and the density of air is superior to that of water vapor in the ratio of 14.4 : 9. Therefore, moist air will be lighter, bulk for bulk, according to its hygrometric condition, and consequently moist air tends to rise as warm air does.

Heating and Ventilation of the St. Louis Public School Buildings*

By William B. Ittner

COMMISSIONER OF PUBLIC SCHOOL BUILDINGS, ST. LOUIS

The public school buildings of St. Louis are built to accommodate all the grades, that is, pupils may pass through all the grades from the kindergarten to the eighth grade, from which they are prepared to enter the high or secondary school.

As a rule, the buildings will accommodate about 1,200 pupils, and contain twenty class rooms, a room for domestic science, a manual training room, a principal's office, two gymnasiums and playrooms, toilets for pupils and teachers and the necessary space for the heating and ventilating apparatus, fuel, etc.

In plan these buildings show a number of radical departures from the conventional type of school building, wherein the central corridor lined with rooms and wardrobes on either side is necessarily dark and without adequate ventilation. It will be noted that wardrobes are entered from class rooms only, enabling their perfect ventilation, the air current entering the room at the inner wall, making the circuit of the room, passing through the opening to and along the entire length of the wardrobe to the vent.

The general plan developed by these requirements is necessarily more or less similar in all of the schools, approximating in form the letter E. The purchase of ample sites has made it possible to limit the height of the buildings to two stories.

All buildings are of fireproof construction, except the pitched roofs, in which cases, for economical reasons, the roofs are of mill construction covered with 1¾-inch matched sheathing and tile.

*Abstract of an article by Mr. Ittner on the St. Louis Public School Buildings, furnished us through the courtesy of the *American Architect and Building News*, for which the general design of the heating and ventilating systems was specially drawn.

DESCRIPTION OF HEATING AND VENTILATING SYSTEMS

All buildings are designed for a low-pressure steam plenum system of heating and ventilation, this work being carried on simultaneously with the plans of the building.

Fig. 1 gives the general basement layout of the heating and ventilating apparatus for the New Baden School, now in course of erection. The main portion of this building is to be two stories in height above the basement, with an ample lecture room located on the third floor. There are eighteen class rooms, a kindergarten and domestic science rooms, making an equivalence to twenty-one class rooms.

The mechanical equipment is designed to furnish the air for ventilation at a sufficient temperature to make up for all losses. Thus there will be no unsightly piping or radiators to contend with in any portion of the building. Each duct, with its sizes marked, runs to risers H-1 or H-2, according to whether it leads to a first or second floor room.

For a detail of the apparatus, reference is made to Fig. 2. The plant is designed to operate under a steam pressure of 15 pounds, with a back pressure of 2 pounds in the coils. The installation consists of two 8 ft. x 4½ ft. fans, direct driven by 15 in. x 10 in. and 18 in x 12 in. engines. The larger engine drives the centrifugal for the air washer, in addition to pulling its fan. This washer is located between the two sets of tempering coils in space marked "spray chamber."

This washer removes practically all foreign matter from the air by passing the same through finely divided sprays of water. An eliminator removes all excess free water

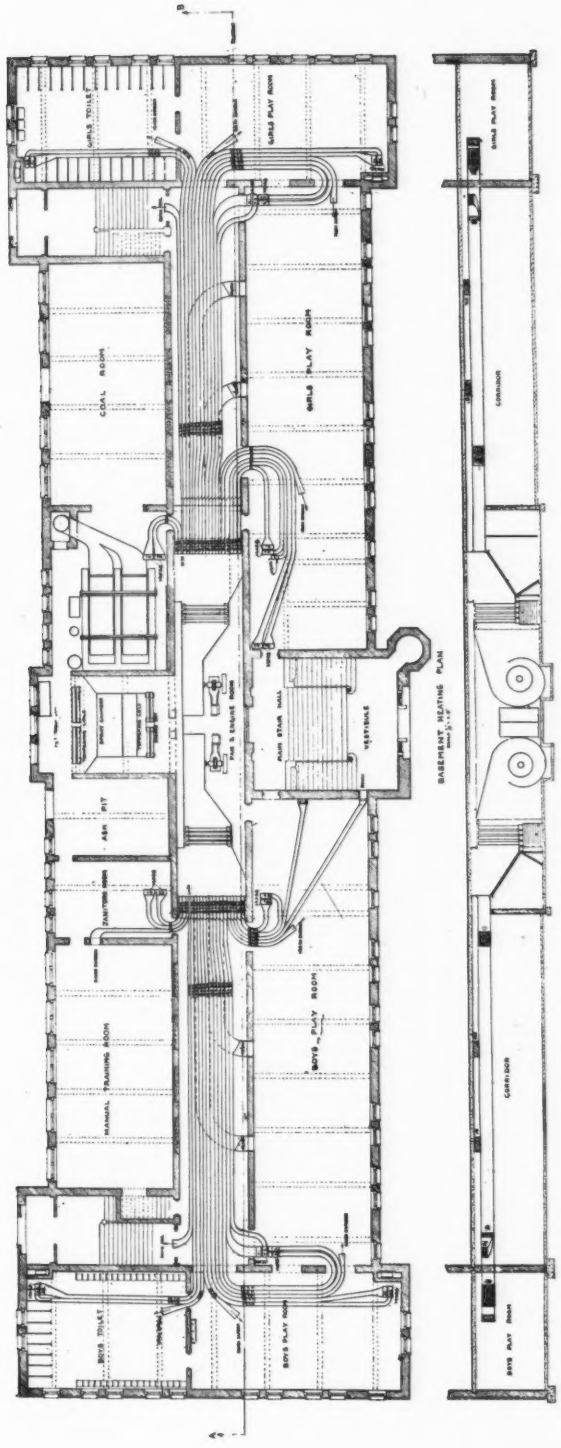


FIG. 1—GENERAL SCHEME FOR HEATING AND VENTILATING SYSTEMS IN ST. LOUIS PUBLIC SCHOOL BUILDINGS

from the air before it comes in contact with the next tempering coil.

The air enters through intake windows, indicated at top of plan, and immediately passes through the first tempering coils. The steam supply to these coils is controlled by a thermostat located in the intake and automatically turns steam into the coils at some point before the outside temperature reaches the freezing point, thus protecting the washer from freezing. By-pass doors are located at the side of coils and these are gradually opened or closed by a thermostat located immediately past the eliminator. Thus a constant temperature may be maintained for the air as it strikes the washer. This is a matter of considerable importance, as it has a bearing on the ultimate relative humidity of the air.

After passing the eliminator, the air meets the second set of tempering coils, which brings the air up to a temperature of 70°. The air then divides and passes into the two fans.

Referring to the "Section of Fan and Engine Room," each fan drives the air through the heating coils into the "Hot Room," and under the same coils into the "Tempered Air Room." Thus the tempering air is not heated after leaving the fan. A thermostat is located in this latter compartment, for controlling the by-pass doors under the second set of tempering coils, thus maintaining a constant temperature of 70°. Tempered air, hot air, or a mixture of the two is forced by the fan into the "Air Ducts." A thermostat located in each class room controls the proportionate quantities by means of mixing dampers, and thus a temperature is maintained varying not in excess of one degree either side of a given point.

A fresh air supply of 30 cubic feet per minute is allowed for each pupil. This necessitates about eight complete changes of air per hour in every class room. Since the corridors and basement are occupied intermittently, four changes per hour are planned for these localities All plants are designed to secure these results with a safe margin of reserve in case it should be required for any reason.

The boiler installation consists of two 60 in. x 16 ft. return tubular units equipped with down-draft furnaces. One boiler will do the work at all times except in extreme weather, when both will be required. The installation of two smaller instead of one larger boiler is advantageous in a number of ways, namely: The small boiler will be more economical of fuel, as it will work at close to its rated output, a reserve unit is on hand most of the time, and less headroom is required, thus reducing the cost of general building construction.

Numerous smoke tests have been made to accurately determine the distribution of air in class rooms of various schools. These tests were made by burning a quantity of red fire powder in the duct where the same leaves the hot and tempered air rooms. This particular powder was selected on account of both its pungent odor and the quantity and color of the smoke, the former attribute making it very easy to determine when a room was thoroughly cleared.

The tests indicated quite clearly the air movement. The fresh air entering the room at a velocity of about 300 feet per minute was evenly distributed over the rear two-thirds of the room, and was gradually driven downward by the continued entrance of fresh air from above, and by the law of diffusion of gases. From the breathing line the air gradually worked both downward and forward to the wardrobe opening, and passed out and into the vent.

During the Christmas holiday recess of '06-'07 extensive tests of the heating and ventilating were made in five newly constructed schools. Especial attention was given to the matter of air volumes, velocities and distribution. The smoke tests previously described were made at that time.

It may be interesting to note a few figures on fuel cost of heating

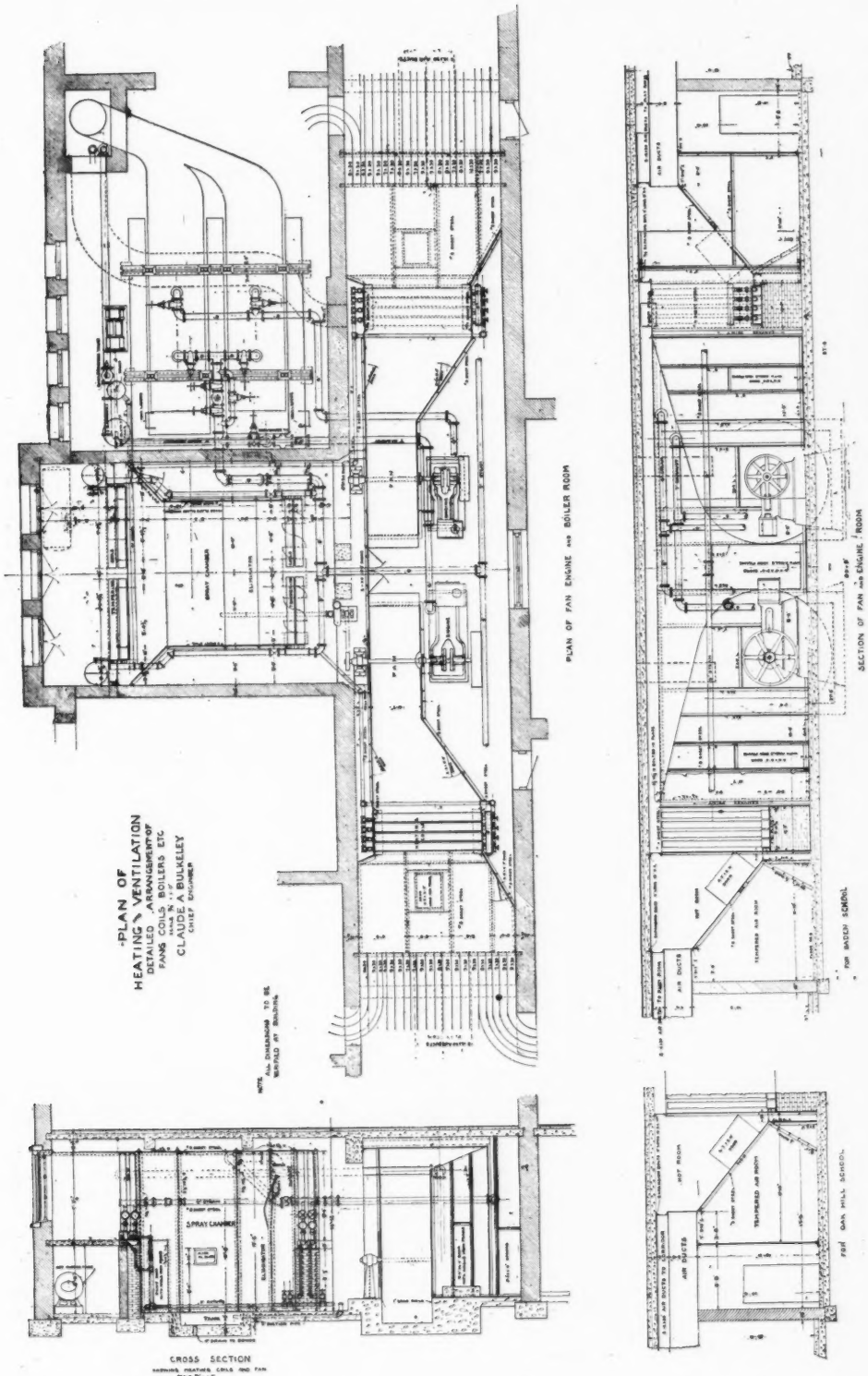


FIG. 2—DETAILS SHOWING ARRANGEMENTS OF FAN, COILS, BOILERS, ETC., IN ST. LOUIS SCHOOL BUILDINGS.

and ventilating some of the schools. One matter drawing special attentin is the fact that a new school requires above 10 per cent. more fuel to operate the first year than is required for succeeding seasons. A cause for this might be found in the fact that the walls are not thoroughly dried out at the start, and act as a better conductor for the heat.

The figures given are for nine schools, and extend over a period of four heating seasons. All these schools are equipped with ventilating fans. During the four years the average mean temperature for the months requiring heat was one degree lower than the average for thirty-four years. The temperature figures are, of course, taken from the United States Weather Bureau statistics.

The total contents of the nine buildings amounts to 5,755,000 cubic feet. The average coal consumption per season for the four years amounted to 1,936 tons, or 673 pounds per 1,000 cubic feet contents. The average price paid for this coal was $1.905 per ton, thus making the fuel cost per season for heat and ventilation amount to a little over 64 cents per 1,000 cubic feet. The coal was of the ordinary Illinois variety mined in the district immediately east of the city.

The above fuel cost of heating and ventilating amounted to about 12½ cents per seat. Even if this entire amount were chargeable to ventilation alone (the item of heating being neglected), the fallacy of arguing against ventilating on account of extra fuel required is immediately shown, when an adequate supply of fresh, wholesome air can be provided for each child at so insignificant a sum as 12½ cents for an entire heating season.

Ozone and the Diffusion of Gases in the Air

Ozone is a colorless gas of peculiarly unpleasant odor. Outside of the laboratory it is found only in open country and sea air. It is chiefly remarkable on account of its oxidizing power, and plays an important part in removing organic impurities from the air. Ozone is really a condensed form of oxygen, one molecule of the gas containing three atoms, whereas one molecule of oxygen contains only two atoms. Air charged with ozone has an irritating effect on the respiratory organs. The gas may be prepared experimentally by passing an electric current through pure dry oxygen. Little is known of the circumstances under which it is produced in nature. It is, however, intimately related with the development of atmospheric electricity.

Although gases are of different densities, they have the power, when brought in contact, of intimately mixing together. This important property is termed the diffusion of gases, and has an important bearing upon the air of buildings, which is kept pure to a large extent by diffusion. Gases diffuse in the inverse ratio of the square root of their densities. The lighter the gas, the more quickly does it diffuse. Diffusion of gases takes place also, to a less extent, without being in actual contact.

The materials used for constructing the walls of buildings permit the air to pass through more or less rapidly to diffuse with the outer air. The spontaneous mixing of gases is caused by their particles being always in rapid motion. A very small quantity of coal gas is soon detected in a building, owing to the power of diffusion. Gaseous impurities which leave our bodies at a higher temperature than that of the surrounding air quickly diffuse and become diluted, but in crowded buildings, and even in dense crowds in the open air, the impurities are often produced at a greater speed than the rate of diffusion.—N. W. HOSKINS *before the Royal Sanitary Institute, London.*

New Foundry of the Michigan Stove Company*

By W. J. Keep and Emmet Dwyer, Detroit, Mich.

On January 8, 1907, nearly the entire works of the Michigan Stove Company were destroyed by fire. Reconstruction was begun at once and by July 1 of the same year, they were entirely completed, having been built on modern lines, substituting alternating electric current and individual motors for belts, shafting and rope drives.

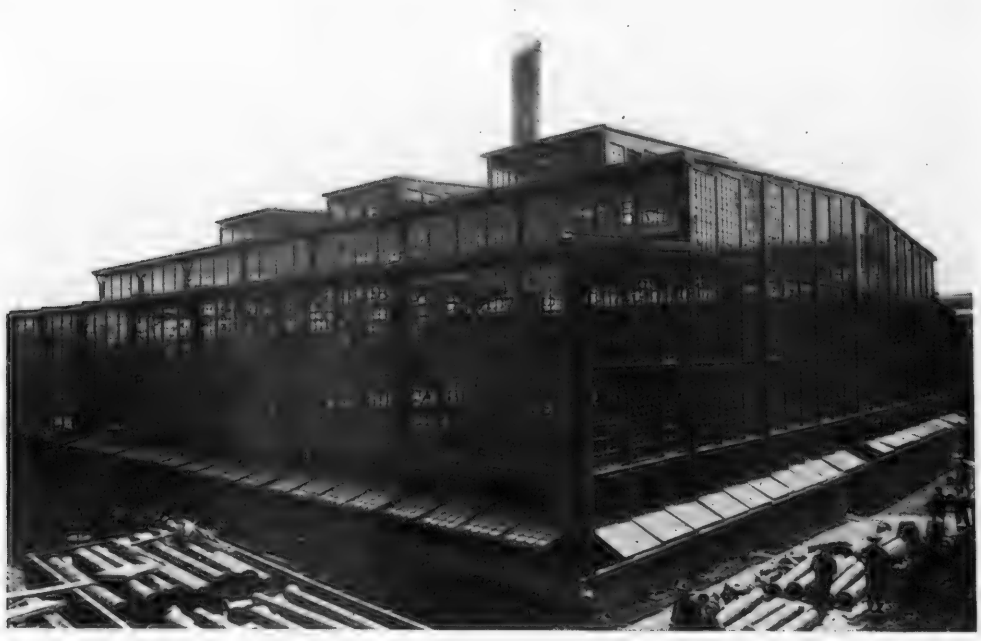
On account of poor light, and lack of good ventilation on hot days, it was difficult to get molders to work in the old foundry. The new works, although surrounded by high buildings, are comfortably cool on the hottest days, and the temperature does not rise much during pouring. Fifteen minutes after the heat is off, the foundry is clear.

Before deciding on plans for the new works the writers visited several foundries, and found that of the American Stove Company at Bedford, Ohio, best suited to their needs. This plan was accepted with the modifications of an extra row of windows in the roof, and three monitors running crosswise instead of lengthwise.

The roof presents some new features as adapted to foundries. A small model was constructed in which an extra row of windows was placed at each side, in the central part of the slope, and the outer edge of each roof section raised to give the usual pitch of a gravel roof.

This arrangement allowed the windows in the roof to be 10 ft. high, and another row 10 ft. high was added on each side, which permitted the use of the ordinary gravel roof, instead of the usual felt roofing with cinders. The disadvantage of the usual form of roofing with the latter covering is that its steep slope does not permit of its being walked upon. The ordinary gravel roof has proved entirely practicable for the purpose.

The foundry is 128 ft. square; the other dimensions are approximately, 50 ft. to the top of the monitors; 40 ft. to the highest point in the roof proper, and 30 ft. to the roof at the sides. The girders are of 18-ft. centers. As an economy in cost, a row of posts was used in the center, instead of having one truss the full length of the span.



NEW FOUNDRY OF THE MICHIGAN STOVE COMPANY

The foundations are of concrete, the walls, 6 ft. high, are of brick 12 in. thick, the balance is constructed of steel, with a rool of 2½-in. matched pine.

The building is so nearly fireproof that it is not considered necessary to install sprinklers. There are hydrants at two places, and fire hose with 100 lb. water pressure. There are no wooden partitions or woodwork other than that covering the steel at the windows—which the architect, being more used to wood than steel construction, insisted upon using to make the building weather proof—and the charging platform, the framework of which, however, is steel with mill construction floor 8 in. thick. It is intended when the wood

*From a paper read at the New York Meeting (December, 1907) of The American Society of Mechanical Engineers, and to form part of Volume 29 of the Transactions.

is perfectly dry (for the purpose of guarding against dry rot) to cover the upper surface with sheet metal and the under surface with some kind of fireproofing.

The height of 30 ft. at the sides of the building is to allow a deck to be erected at some future time on the line of the top of the first row of windows. The present plan is to begin the deck 10 ft. away from the side windows, making it wide enough to accommodate one row of molders, with a gangway at the edge toward the center of the foundry. The under side of the deck will be 12 ft. from the foundry floor, and the deck floor about seven feet from the underside of the lowest member of the truss.

The floor is of brick, laid in cement. One corner, 18x60 ft., is used for a core room, and besides there is ample room for 86 bench molders.

It has not been found necessary to open the monitor windows, it being cool enough when they are closed, but every second window can be swung open. All of the others are stationary except the bottom row, where each window swings open.

Some difficulties were met in removing the cupola from the old location to its present site a distance of 45 ft. It has a 72 in. shell, is 75 ft. high, lined to the top, and is estimated to weigh 76 tons. The local movers were asked to submit bids, the lowest of which was $600, and there was no competition for the order even at that price. Finally a house mover agreed to move it for $175. There was no guarantee against accidents in any case.

The company furnished 5/8-in. wire rope for four guy ropes, which were fastened at their outer ends by tackle, and provided the men to manage them.

Two timbers were placed under the cupola from front to rear, and one crosswise. These and the cupola were raised with ordinary movers' jack screws until 5-in. wooden rollers and timbers to roll on were placed beneath. A cross timber was fastened by chains on the under timbers, and jack screws between this cross timber and the ends of the timbers and directly under the cupola shoved the cupola along.

To insure its being kept plumb, a timber projected from the charging platform door, from which a plumb-bob was suspended by a wire. A plank fastened to the base of the cupola with a nail driven so that its head was directly under the point of the plumb-bob, told which way to raise the blocking. After everything was ready the cupola was moved in ten hours. The mover made a profit of $75, and the entire cost to the company was $225.

The foundry will be heated by the forced circulation of hot water, which is to be kept at 157°. The temperature at zero weather is guaranteed to be 45°. The radiation is estimated at 4,300 sq. ft. of radiating surface, using 1½-in. pipe.

Hints on the Preparation of a Paper and Its Illustrations

Acting on suggestions made at former meetings of the Institution of Heating and Ventilating Engineers, Mr. W. A. Young has given some interesting hints to be followed in the preparation of technical papers. The remark is frequently heard at meetings of engineering and similar associations that the author has omitted this or that feature which would have added greatly to the value of his contribution. Sometimes it is a condition of a test that has been overlooked and, very often, it is an incomplete description or tabulation that is simply the result of lack of thought.

CHOOSING A SUBJECT

"The choice of a subject," says Mr. Young, "is usually more troublesome than the actual work of writing. Without being hypercritical, it is not overstating facts to remark that some of the papers, which have been read before this institution, have hardly been worthy of a permanent place in the proceedings, and the reasons for this unsatisfactory state of things are not far to seek. The subjects chosen have been either too comprehensive to admit of adequate treatment in the space and time allowed, or they have been discursive and consequently, while sometimes provocative of useful discussion, have not disclosed information likely to be useful to the members, who presumably come to the meeting wishing for information in connection with the profession.

"It seems to me that the first and chief characteristic of a really useful paper lies in its practical character and its completeness. Comparatively restricted subject-matter, if it can be worked up so that all sides are examined, if it is turned inside out and every detail thrashed out, will prove more valuable than the presentation of the main outlines of a big scheme. It is quite a mistake to suppose that the method, or line of conduct, which is obviously that of the least resistance to our own mind may have occurred to our neighbor. It is one of the surprises of journalistic work to find what a lot of people there are who know nothing about many matters most nearly connected with their own daily occupation.

"After choosing a subject nothing pertinent to the matter ought to be omitted from the paper. This suggests the next characteristic to be aimed at, namely, a terse conciseness. If all that can be said is to be stated, and that well, the writing must be 'lean.' Unnecessary verbiage, excursions into side issues even remotely relevant, must be left severely alone, or cut out with a merciless hand, if from lack of practice they are allowed to slip into the first draft, for every paper will,

of course, be rewritten at least once. The question of style must be left to the individual, but one or two hints may not be out of place. It is sound advice to recommend members to avoid the use of the imperative mood in conveying information. May I repeat the sense of that sentence, because I want you to look at it and compare it with my next? Don't use the imperative mood in constructing a sentence intended to convey information. Spoken, this form is not objectionable, and in the workshop it has an authoritative directness about it which makes it desirable. In cold type it does not appear so pleasant nor convincing as a more persuasive form. Speaking from a purely selfish point of view, that of the journalist, who has to transpose your remarks from the direct into the oblique narration, when the present tense of the article in altered to the past of the newspaper report, I counsel the sparing use of the first person singular. Quite apart, however, from my point of view the little letter sprinkled like milestones or lamp-posts over the page, does not suggest a becoming modesty.

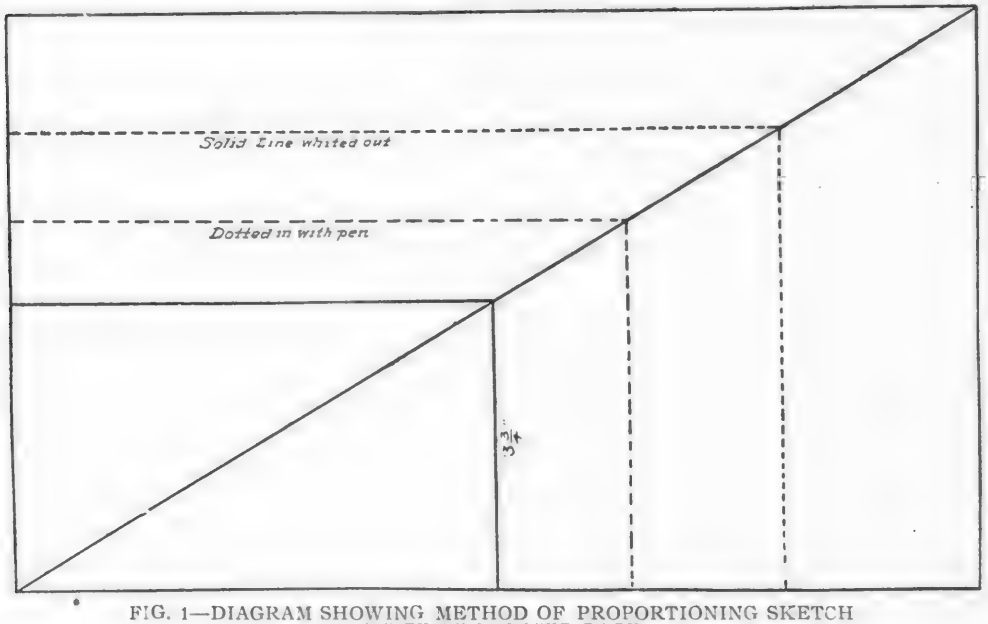


FIG. 1—DIAGRAM SHOWING METHOD OF PROPORTIONING SKETCH TO SIZE OF PRINTED PAGE

THE ARTICLE AND THE PROOF

"When the draft has been written it should be put aside for a few days before the revised, clean copy is made. This plan allows the ideas, remarks, comments, and all the rest of the good things which have been committed to paper without banishment from the mind to simmer there. Then when the revision is undertaken little errors and omissions will be noticed and general improvements can be introduced.

"A word about the time for sending in. A paper to be read at any meeting ought to be in the secretary's hands three months before the meeting at which it is to be read. That only allows those three months for the paper to be considered in committee, composed, if accepted, the revised proof sent to the writer for corrections, which have to be carried out before it can be printed and copies prepared and dispatched to the members. May I put in a word for a thoughtful revision of the proof? I am quite aware that when a piece of printed matter lies before its author for the first time it looks very different from the original. So much that might have been written is found to have been omitted, and much that is there seems indifferently well expressed when it is in black and white. The author should weigh well the reasons before interpolating a lot of new matter, or making extensive corrections. You will have the right to reply to any criticisms, and that occasion affords an opportunity for elucidating points which may not be clear, or for supplementing the information imparted.

ILLUSTRATIONS

"Sketches should be made on Bristol board or a smooth drawing paper with India ink of good color and quality. The preliminary lines in pencil and not inked in need not be rubbed out if they are quite faint, but colored inks of any kind are not permissible. Blue does not come out in the reproduced sketch at all, but red would appear black, though not always of a good color. Black lines on a white ground are all that are favored by the engraver, though hatching may be indicated by blue pencil marks over the surface to be covered. What is known as a 'tint'-dotted shading can be

produced, also photographically, if the original is light-shaded with a blue pencil. The fact that these 'tones' can be made by means of screens is not as well known as it might be.

SIZE AND PROPORTIONS OF SKETCH

"To insure a nice appearance a sketch ought to be drawn on a base with a height proportionate to one or the other of the two fixed dimensions of the page of the proceedings. The rule is to construct a rectangular figure representing the desired actual size. Then, according to the shape in relation to the page, the longer or shorter base should be extended to the proposed full length of the drawing to be made. A line is next drawn diagonally from the bottom left-hand corner and extended through the top right-hand corner, sufficiently long to intersect a vertical line thrown up from the end of the base. The rectangular figure, when completed, will give the dimensions within which the full-size sketch should be made. Fig. 1 will make this rule clear. It has suited my purpose to show this diagram with a base representing twice the original length, because I want to emphasize the fact that instructions to reduce from 12½ inches to 6¼ inches this way is not the same thing as making a sketch half size. Reducing the base to half length means a block which, superficially considered, is only a quarter of the size of the original drawing, while a big sketch reduced to a third or fourth of its length may come down so small as to make it difficult to decipher the details or lettering. Especially in the case of figured dimensions should these facts be kept well in mind."

COLD STORAGE BY MEANS OF ICE

Gravity Brine Circulation

In discussing the subject of cold storage by means of ice at the recent annual meeting of the American Society of Refrigerating Engineers, the speaker, Mr. Madison Cooper, of Watertown, N. Y., gave the following interesting description of a gravity brine system of circulation which operates on the same principle as a hot water heating plant, but in a reverse direction:

The principles of the Cooper system of gravity brine circulation are so simple as to need very little study to thoroughly understand. The details of construction are, of course, more or less complicated, depending on the purpose for which the plant is to be operated, etc., and need not be touched upon at this time.

Essentially, the gravity brine system consists of a continuous pipe, a portion of which, in the form of a coil, extends through a tank or receptacle which is filled with a mixture of broken ice and salt; and another portion of which, exposed at a lower level, extends through the room or medium to be cooled.

The pipe is first filled with brine of the proper density; the coil in the tank is surrounded with ice and salt; and the system is immediately in operation. The brine being cooled in the tank becomes heavier and circulates down into the portion of the pipe at a lower level and surrounded by a comparatively warm medium. Becoming warmer and lighter, it circulates upwards into the portion of the pipe in the tank. Ice and salt being maintained in the tank, it will be readily seen that the circulation will be continuous.

It might be stated in passing that the patent claims allowed on this system cover not only the gravity circulation as described, but a circulation of brine under this arrangement by means of a pump. Temperatures as low as 10° F. are obtainable with the gravity brine system in practical operation, and a temperature of 6° F. has been produced on a test.

EFFICIENCY OF SYSTEM

The question which presents itself at this point is the comparison between a room cooled by the gravity brine system and by direct expansion ammonia piping, or by brine piping cooled by expanding ammonia in connection with a refrigerating machine. If the pipe surfaces of the gravity brine system which are exposed in the storage room are maintained at the same temperature as the ammonia coils or brine coils of the mechanical refrigerating plant, there need be no comparison. Results are identically the same. This point admitted, the gravity brine system takes its place on an equal footing with mechanical refrigeration so far as results in connection with cold storage is concerned, within the ranges of temperature through which it is able to work.

Economy of operation depends, of course, largely on local conditions. There may be some places where the ice costs are so high as to make the gravity brine system out of the question, but in connection with small or medium sized plants it is safe to say that in a great majority of cases where cold storage is desired, and especially in small units, the gravity brine system can be operated not only for less, but generally at a cost not exceeding one-half the expense of operating a refrigerating machine.

In connection with small plants ranging in capacity up to several car loads, no machinery is required in the operation of the gravity brine system, as the ice may be broken by hand and raised to the primary tank with a windlass or hoist. In larger plants it is desirable to install a power ice crushing machine and a chain belt bucket elevator for elevating the crushed ice to primary tanks. The apparatus is all simple, and even in case

of breakdown of same the ice may always be elevated to tanks in some other way.

Ease and simplicity of operation are always desirable, and in a small plant absolutely essential. The gravity brine system may be attended to by any man who will do as he is told, and there is nothing about the system which he can damage. The gravity brine system is in fact as near "fool-proof" as a successful cold storage apparatus can be made.

PREVENTION OF FROST ON COOLING COILS

While not coming strictly under the head of "Cold Storage by Means of Ice," it is desired to call attention to the chloride of calcium process for preventing frost on cooling coils, and at the same time purifying and drying the air of the cold storage room. This scheme was devised by the writer to meet a situation where it was impossible to clean the frost from the cooling coils. The scheme is extremely simple yet new, and when a patent was applied for claims were allowed practically as drawn and do not confine the process to any particular mechanical details. It is only necessary to support chloride of calcium in such relation to the cooling pipes that the brine resulting from the moisture in the air being absorbed by the calcium, will trickle or drip down over the pipes. The benefits to be derived from the chloride of calcium process are much more important than is apparent or readily understood without having used same. It is mentioned here, for the reason that it is always installed in combination with the gravity brine system, and these two systems together, the writer fully believes, constitute the most successful and satisfactory system to be obtained for small or medium sized plants, and in country locations, where natural ice may be obtained at low cost, large plants as well.

The Contamination of the Air of Our Cities With Sulphur Dioxid

By Theodore W. Schaefer, M.D.

The importance of sulphur dioxid as an impurity of the air of our cities and its injurious effects upon the organs of respiration is a subject that has not received the attention in works on hygiene which it demands. Most of the works on hygiene give us but a very meager information or none at all of sulphur dioxid as an impurity of the atmosphere. They chiefly mention and describe its antiseptic and disinfectant properties.

The writer has been studying the noxious effects of sulphur dioxid as an impurity of the atmosphere for the past ten years and he had arrived at the conclusion that it is one of the most potent causal factors of asthma.

The atmosphere, being a mixture of gases, gives, according to the most recent investigations, the following average composition in one hundred volumes:

Oxygen	20.60 volumes
Nitrogen	76.90 volumes
Argon	1.00 volumes
Carbon dioxid	0.04 volumes
Aqueous vapor (about)	1.46 volumes
Ozone, hydrogen dioxid, Nitrogen acids, Marsh gas, Sulphur dioxid (in towns and volcanic districts), Hydrogen sulphid	traces

Besides the three above-mentioned elements there are in the air hydrogen gas (according to Gautier 0.015%), neon, krypton, xenon, helium and coronium, which have only a scientific interest. According to Mendeléeff's "Periodic Law" a number of other elements are believed to exist in the atmosphere, but remain to be discovered by the chemist in the near future. Dust, being a normal constituent, is found in the air at all times.

PRESENCE OF SULPHUR DIOXID IN SMOKE AND FOG

Since the air is the great receptacle for all gaseous emanations other substances, in the vapor or solid form, may be discovered in it by chemical and microscopical means. Sulphurous anhydrid or sulphur dioxid, for instance, can often be traced in it, being derived from domestic, manufacturing or tellural sources.

In the combustion of coal, which contains iron pyrites (FeS_2), and coal gas, which contains hydrogen sulphid and other gaseous sulphids, the sulphur is oxidized and converted into sulphur dioxid, which passes into the air in which it is rapidly diffused.

The air of every large city, especially in the manufacturing districts, becomes polluted with free sulphur dioxid in variable proportions. To form even an approximate idea of the enormous quantity of waste matter poured into the air of a city like London, it is worth while mentioning the statement quoted by Egbert, that "It has been calculated that for every ton of coal burnt in London something like three tons of carbon dioxid are produced," and as the city's coal consumption is over 30,000 tons per diem, we can see that its atmosphere must receive the enormous daily contamination of about 300 tons of soot and 90,000 tons of carbonic acid. From this calculation the writer has made another proportionate calculation from which he finds that at least 2,700 tons of sulphur dioxid are produced at the same time, helping to augment the further daily pollution of the atmosphere of that city.

Sulphur dioxid, after uniting with the oxygen and aqueous vapor of the air, is converted into sulphuric acid.

VARIABLE PROPORTION OF SO_2 IN THE ATMOSPHERE OF CITIES

The proportion of carbon dioxid is an index of the amount of sulphur dioxid

in the atmosphere. When the amount of carbon dioxid is increased the proportion of sulphur dioxid is correspondingly augmented in the air of cities and manufacturing districts. Every ton of coal in burning yields its proportionate volume of carbon dioxid and sulphur dioxid, for every sample of coal contains a certain percentage of sulphur in the form of iron pyrites.

The proportion of SO_2 in the atmosphere of cities is not constant throughout the year. There is more SO_2 in the air in winter than in summer. There is an excess during heavy fogs, attaining, at times, almost the CO_2 equivalent of the atmosphere. As the amount of carbon dioxid varies in the cities, so also does the quantity of sulphur dioxid vary. During the night the sulphur dioxid increases in exact ratio with the progressive increase of carbon dioxid. During the prevalence of thick fogs, the air being in a stagnate condition, the sulphur dioxid equivalent is correspondingly increased with the carbon dioxid content. As much as 8 or 9 volumes of carbon dioxid in 10,000 volumes of air having been noticed on a foggy day, we infer from this likewise a proportionate increase of sulphur dioxid, there being, however, no recent exact quantitative data of sulphur dioxid determinations in the atmosphere at hand.

The writer believes that sulphur dioxid, being a very heavy gas, with the specific gravity of 2.25, is alone capable of creating a fog, as is at once shown when it is brought in contact with the atmosphere, from which it absorbs aqueous vapor, causing dense, heavy fumes. The dust or carbon particles, coming in contact with this acid vapor, enhance its gravity materially. Fog usually collects in the lower portions of a city, especially in depressed localities known as "hollows," where it remains until dispersed by air currents. The reason for all this is explained by the physical properties of heavy gases. Fog also contains an excess of carbon dioxid, having a specific gravity of 1.524, it being consequently one-half heavier than atmospheric air. Fog also contains an excess of sulphur dioxid, having the specific gravity of 2.25; the latter gas is, therefore, two and a quarter times heavier than air.

EXAMINATION OF THE AIR FOR SULPHUR DIOXID—DETECTION AND ESTIMATION OF THE GAS

Recently (during the early mornings of January 31 and February 12), when the fogs were so bad in this city, it being virtually in a so-called "smoke-bank," the air being very irritable and exceedingly unpleasant, and at the same time unfit to breathe, the writer exposed strips of moistened blue litmus paper to the atmosphere. In a comparatively short time these papers were colored decidedly red, showing the highly acid nature of the atmosphere. The outside window panes and roofs of buildings, when touched with moistened blue litmus paper, gave promptly a decided acid reaction. The outside window panes were sprinkled with distilled water, which was again collected and filtered and treated with a few drops of bromine water and barium chloride solution, when a distinct precipitate of barium sulphate was obtained. In testing rain water with blue litmus paper the latter was instantly colored red. A sample of rain water was treated with barium chloride solution, which gave a characteristic whitish precipitate of barium sulphate, proving conclusively the presence of free sulphuric acid.

The most delicate means at our command for the instant detection of very minute traces of free sulphur dioxid in the air is simply by the sense of smell.

It is stated in works on analytical chemistry that paper moistened with starch paste and iodic acid solution turns blue in air containing one part of sulphur dioxid in 3,000 parts of air. This test, however, after repeated trials, is not sensitive for very minute traces of SO_2, say 5 parts or less in 10,000 volumes of air. The writer has tried patiently a number of tests in the form of test papers, but he has not found one of them reliable for the detection of minute traces of the gas. Papers containing mercurous nitrate, potassium bichromate, potassium chromate (which turns coffee brown in color, and ultimately green), etc., respond only in dense fumes of the gas.

METHODS OF DETERMINING AMOUNT OF SULPHUR DIOXID

The amount of sulphur dioxid in the atmosphere may be determined volumetrically and gravimetrically.

Volumetrically, SO_2 may be estimated by shaking a given proportion of normal solution of potassium hydroxid in a measured vessel containing air, treating the solution with sulphuric acid (1:3), adding a little starch solution, and then titrating with $\frac{N}{50}$ iodine solution until a blue color is produced. One cubic centimeter iodine solution is the equivalent of 0.00064 gr. of normal SO_2.

The proportion of SO_2 may also be estimated gravimetrically by precipitation as barium sulphate by the addition of barium chloride, bromine water having been previously added. "One milligram of barium sulphate is equivalent to 0.2748 milligram of SO_2." (Harrington.)

Briefly stated, the measured capacity of the air-contained vessel and the given amount of absorbing solution, with the observed barometric pressure and observed temperature, give the estimated volume of SO_2 in the air. It being customary to express results in parts per 10,000, the rate is determined by simple

proportion. Specially constructed apparatus, like those used in the determination of CO_2 in air analysis, might be used for the estimation of free SO_2.

The United States Weather Bureau should take charge of the chemical examination of the atmosphere in every large city and make daily examinations (especially during the winter months) of the air by scientifically educated persons, in order to attain its highest standard of efficiency. During dense fogs the air should be analyzed qualitatively and quantitatively in order to determine the presence of deleterious impurities, especially that of SO_2. The object of such work would be to trace the influence of the presence of abnormally increased impurities in the air and their effect upon public health. The various diseases of the air passages, including pharyngitis, bronchitis, pneumonia and asthma, are materially influenced by meteorological conditions.

LEGISLATION AND PREVENTION OF THE POLLUTION OF THE AIR

Man disposes of his sewage and dejecta in a most peculiar manner by casting them into the streams and large bodies of water from which he derives his water supply. In a like manner he ignorantly pollutes with poisonous gases the very air he breathes!

It stands to reason that factories, manufacturing plants and other large industrial establishments modify seriously, by their excessive smoke, the atmosphere of cities by the addition of a deleterious gas like sulphur dioxid and they should, therefore, for hygienic reasons alone, be located at some distance from cities. The importance of smoke, says Harrington, both as a promoter of disease and on account of its corrosive and disfiguring action on buildings, and also on account of the obstruction of light, has led to much legislation and to the exercise of inventive genius for devising means for the prevention of its discharge in objectionable amounts into the atmosphere of cities.

In January, 1902, when we were suffering in this city from heavy fogs, contaminated with acid, suffocating gases, the city of St. Louis had the same trouble, where the responsibility of a city for maintaining a smoke nuisance was tested in court. Because the throat and lungs of a prominent singer were injured by smoke, the city of St. Louis and its chief smoke inspector were sued in a mandamus proceeding, asking that they be compelled to abate the smoke nuisance. Litigations on account of destruction of vegetation, especially of vegetables, garden fruit and fruit trees, have been often instituted against smelters and sulphuric acid works.

Instead of permitting colossal quantities of sulphur dioxid to go to waste by passing into the atmosphere, thereby occasioning serious atmospheric contamination and economic damage, means and ways should be devised to recover the enormous quantities of SO_2 thus lost. Industrial application should be made of SO_2 as in the case of carbon dioxid, CO_2. Sulphur dioxid could find many a useful technical application in the arts and industries.

Writers on hygiene and sanitation have paid but little attention to the subject of air vitiation by sulphur dioxid gas, consequently their information is very limited and it is no wonder, then, that one, among the rest, has made the careless statement in his otherwise very excellent work on hygiene that its effects "are exerted more on the digestive (?) than on the respiratory function."

From the presentation of all these facts it will appear evident that the weight of evidence concerning the relation of this gas to public health indicates that its effects are really "serious if not lasting" on certain susceptible persons, and that its presence in atmospheric air is a positive menace to the hygienic welfare of beings.—Dr. Theodore W. Schaefer, in the *Boston Medical and Surgical Journal.*

Moisture in Buildings

Consul W. P. Atwell, in a report from Ghent, Belgium, tells of successful experiments in that city which are interesting as to hygiene of dwelling houses, as well as to the preservation of monuments and public buildings. He writes:

"The Ghent city and university libraries were seriously threatened by humidity, and certain parts could no longer be used and had to be completely abandoned. It was therefore decided that a trial would be made with a new system of drawing humidity out of walls, which has recently been invented by a Belgian, after long and patient researches. The experiments began July 14 and were completed on August 14. The hygrometrical degree of the air in the room, of approximately 1,200 cubic meters (42,377.3 cubic feet), where the different experiments took place, was 83° on July 13. At that time a strong moldly smell was found to exist. The greater part of the wall was covered with saltpeter, while the floor or pavement was almost continually wet. On September 13, after testing the new system thirty days, the hygrometer was found to have lowered from 83° to 60°. The walls had become completely dry, and the saltpeter and smell had disappeared. The pavement was perfectly dry and remained so, while prior to these experiments it had always been found to be moist. In Belgium the normal hygrometrical atmosphere of buildings in good condition varies between 60° and 70°.

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ALMOST every heating engineer has his short-cut methods of solving the problems involved in his work. Many of these methods depend on rules of thumb, but where they have a scientific and accurate basis, they constitute an interesting study, exhibiting, in many cases, unusual ingenuity on the part of those who compile them. Their value, too, as time-savers, is often very marked, as, for instance, in the case of the heat loss charts, published in our last issue, or the hot blast coil charts, published the month previous.

The tendency to reduce heating calculations to a scientific basis, involving more or less extensive figuring, carries with it the necessity for scientifically-simplified methods, so to speak, and the practice has become so general as to invite a consideration of those found to be of more than ordinary merit.

In the series of articles commencing in this number on the subject of data for a heating engineer's handbook, we believe we have found a collection that will fulfill the requirements of the up-to-date heating engineer for quick and easy methods of applying scientific rules and formulæ. While there is but little distinctly new in the data presented, they are so arranged that their usefulness will be apparent to all who study them and will, we trust, be of aid to many in the matter of accuracy and time-saving. The fact that the data, as arranged, have been in constant and successful use in the designing of large and important installations is an additional feature of their reliability that will no doubt be appreciated.

It is our purpose to present the more important portions of what will eventually form a complete heating engineer's handbook. The second article in the series will take up the matter of pipe sizes, concerning which the author has given much time and thought in an effort to simplify the selection of proper sizes of steam and hot water pipes for various duties.

A PROPOSAL that cities employ a competent inspector of construction work, with particular reference to the installation of heating plants and electric lighting systems, is made by the State Fire Marshal of Wisconsin, in a recent bulletin issued by his department. In support of this proposal, it is stated that the majority of destructive fires during the winter months are directly due to faulty construction or to improper care of flues. The most common chimney defects, says the report, are faulty construction through the use of inferior brick or mortar which crumbles away, leaving cracks through which sparks may be thrown into the room or attic.

IT CAME out in St. Paul, Minn., during the past month, that the local gas company, which also furnishes steam for heating purposes to many of the city's buildings, including the city hall, has no franchise for maintaining steam pipes in the streets, its rights being confined to gas pipes. As a result of the discovery the city has been enabled to close the best contract it has ever made for heating and lighting the city hall.

A CURIOUS situation has arisen in Milwaukee in connection with the central station steam heating system in that city as the result of the surrender of the heating franchise of the Central Heating Company and the company's application for an "indeterminate" franchise, coupled with the granting to another company of an "indeterminate" franchise covering the same ground. The whole transaction is due to the recent passage of a public utilities law in Wisconsin. According to the statute, it becomes the duty of the State commission to decide whether public convenience and necessity require additional facilities in the way of light, heat or power in any city, and that until the commission so decides, the company already in the field must remain in undisturbed possession through the operation of an "indeterminate" franchise.

Therefore, when a new heat, light and power company applied for such a franchise, the Central Heating Company, which practically occupies the field, suddenly surrendered its former franchise and applied for an "indeterminate" franchise. Matters became complicated when the city council practically granted both companies the desired rights.

Much now depends upon the action of the State Board of Public Utilities. If, on one hand, the board decides that the old company is not living up to requirements, it will undoubtedly support the new company in its newly-granted rights, while, on the other hand, the decision of the State board that the city is sufficiently well served at present would render the competing company's franchise null and void.

In either case the State law is made a target for many editorial flings on the ground that it operates to take away from municipalities the right to regulate their affairs of this nature.

AN INTERESTING point raised in connection with the discussion of the rights of the respective companies to lay steam and other pipes in tunnels in the city's streets has to do with the authority of a city or State to grant the use of the space below the surface of the streets for such purposes without first gaining the consent of abutting property owners. It is claimed that the form of "indeterminate" franchise now granted by the State board ignores the rights of the property owners and opens a vast field for litigation.

OWING to an increasing demand for back numbers of THE HEATING AND VENTILATING MAGAZINE, necessitating a larger reserve supply, it has been found necessary to make the price of all back numbers 15 cents instead of 10 cents, as heretofore. Our readers are advised in this connection that extra copies for November, 1905, and March, 1906, have been exhausted and the editions for those months are now out of print.

Air Leakage Around Windows and Its Prevention

EDITOR HEATING AND VENTILATING MAGAZINE:

The writer read with interest the article on "Window Leakage and Its Effect on Radiation" by Burt S. Harrison in the November issue of your magazine. The charts accompanying it cannot fail to prove of great value. Mr. Harrison's statement that "leakage of air around windows is an element which often does not receive proper attention" is undoubtedly true. It is also true that the prevention of this leakage has received less attention than it merited.

Some time ago the writer, who was then engaged in steam-heating work, encountered a circumstance which, to him, seemed of great significance and caused him thereafter to devote his entire attention to window leakage and its prevention.

The Mount Royal apartment house had been built in Baltimore and equipped with an efficient heating apparatus, designed by Mr. Ed. K. Munroe. During its first season this apparatus was very satisfactory, supplying sufficient heat with a reasonable economy of fuel.

This building is located near the Union Station, where smoke and dust are prevalent. To overcome this nuisance, the building, after standing one year, was equipped with metal weather strips. It was then observed that the temperature of the rooms was too high and could only be reduced to normal by reducing the steam pressure to the lowest point consistent with circulation. Clearly, the radiation, which was barely sufficient originally, was too large for the new conditions. Acting on this assumption, the radiating surface was reduced nearly one-fourth and the difficulty was remedied. The result of the joint action of the weather strip and the reduction in heating surface was to lower the coal consumption 35%.

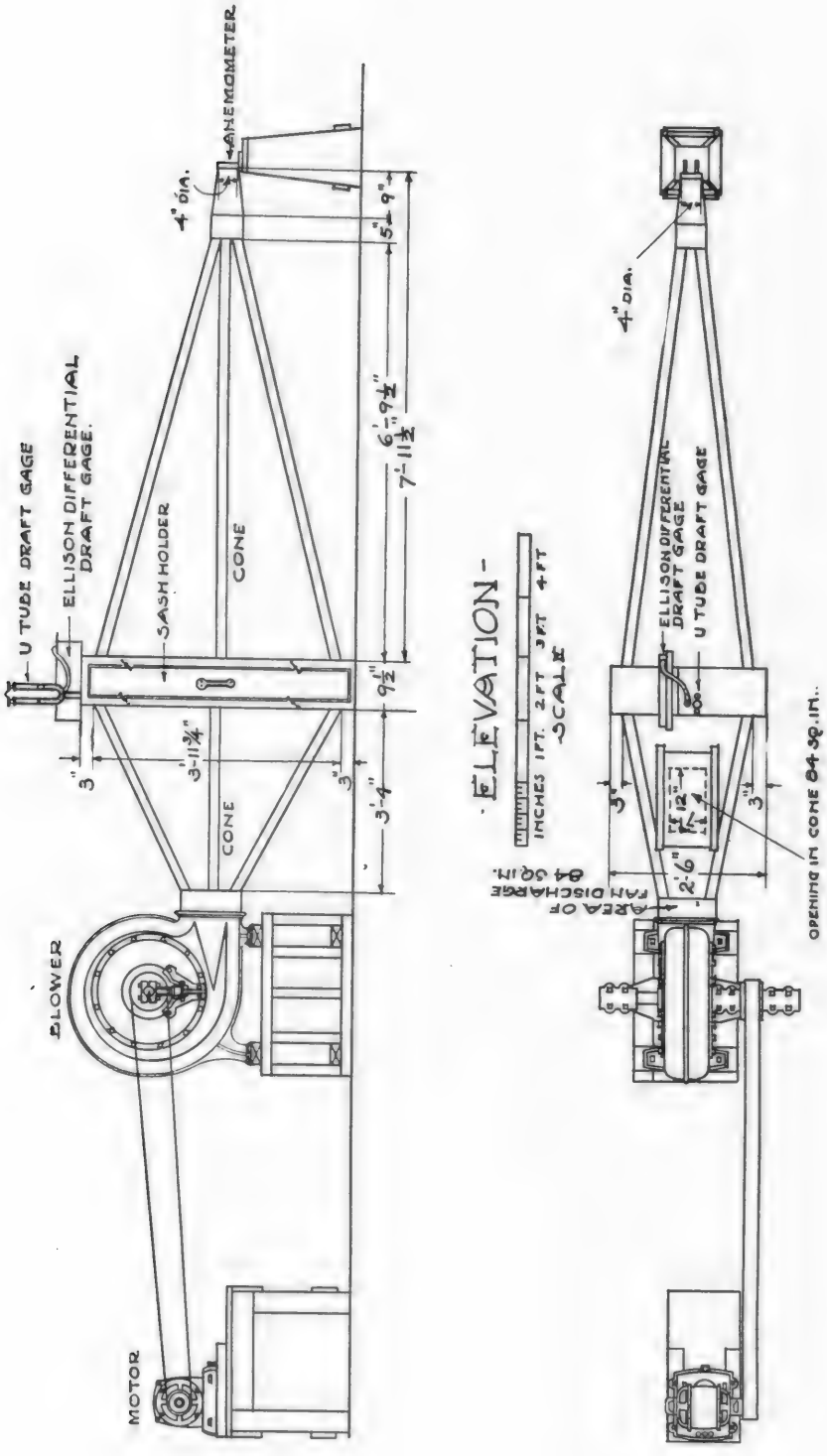
It occurred to the writer that if this weather strip enabled part of the heating surface to be dispensed with, it could be utilized to reduce the heating surface before same was installed. To arrive at a basis of calculation, various tests were made.

Many users of this form of weather strip had testified to its fuel-saving qualities, these varying from 15% to 30%, without any reduction in size of heating plants. This 15% to 30%, it was apparent, must have some equivalent in heating surface.

The accompanying apparatus was

LEAKAGE OF AIR UNDER FAN PRESSURES THROUGH WINDOWS

Air Pressure in Inches	Corresponding Wind Velocity in Miles Per Hour	2 ft. x 4 ft. Ordinary Window. Cubic Feet of Air Per Minute Passing Through Sash		Window Equipped with Weather Strip. Cubic Feet of Air Per Minute Passing Through Sash
		Clearance $\frac{1}{16}$-in.	Clearance $\frac{1}{32}$-in.	
0.03	7.75	22	7.4	....
0.05	10.78	31	15.0	....
0.08	13.66	..	....	1.4
0.1	15.11	43	24.7	2.8
0.2	21.61	57	37.4	5.3
0.3	26.48	71	47.4	8.4
0.4	30.57	83	57.4	9.6
0.5	34.18	99	65.1	10.7
0.6	37.44	103	73.1	11.7
0.7	40.45	112	80.7	12.4
0.8	43.24	121	88.1	14.0
0.9	45.86	130	95.0	15.6
1.0	48.34	137	101.4	16.1
1.3	55.19	160	124.5	20.7



APPARATUS FOR TESTING AIR LEAKAGE THROUGH WINDOWS, SHOWING OPENING IN CONE USED TO REGULATE AIR PRESSURE

designed to measure the leakage under fan pressure through sashes with 1/32-in. and 1/16-in. clearance, one without weather strips and one with weather strips being used. Many tests were taken with uniform results. The result of one made August 6, 1907, by Mr. Ralph Collamore, of Detroit, Mich., and the writer, appears in the following table. It should be remembered that these tests were comparative only, being designed to show the percentage of leakage eliminated by the weather strips.

The writer agrees with Mr. Harrison that the conditions of this method of test do not exactly duplicate those found in a building, and also agrees in the main with the substance of your editorial on page 26 of the November issue. The writer of the editorial is,

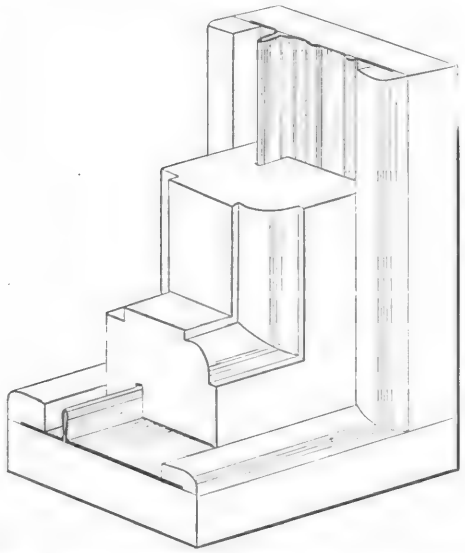


FIG. 1—DETAIL OF WINDOW SASH EQUIPPED WITH METAL WEATHER STRIP

however, under a misapprehension regarding one point. It is stated that these tests were made by "forcing air upon a window surface through an *air-tight* cone." This is true only in the case of the maximum pressure (2.3-in.). It will be noted by referring to the illustration of the apparatus that a large opening was made in the upper side of the cone between the blower and sash. This was fitted with a sliding cover which, when closed tightly, enabled a pressure of 2.3-in. to be registered. To get the lower pressures, the sliding cover was opened, allowing air to escape laterally from the cone. The wider this opening was made, the lower the pressure registered.

It would seem to the writer that during the middle and lower pressures, there being a large lateral

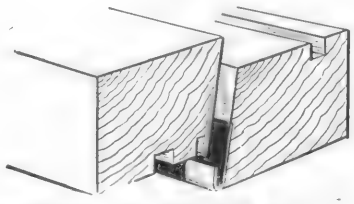


FIG. 2—DETAIL OF MEETING RAIL OF WINDOW EQUIPPED WITH METAL WEATHER STRIP

movement of air, the condition then approximated more nearly those in an actual building. In any event, the test opens a fruitful field of investigation.

Having begun the study of window leakage and its prevention, with a view of reducing radiation and fuel consumption, several phases of the problem presented themselves:

First. It was evident that if a weather strip was to be made the basis of a reduction of heating surfaces, it must be of a permanent character.

Second. It must be of a mechanically correct design, allowing easy movement of sash while effectually preventing passage of air.

Third. It must not be affected by changes in atmospheric conditions, swelling and shrinkage of frames, sash, etc.

After thoroughly investigating all such devices known to him, the writer became convinced that the Chamberlin metal weather strip was the only one that fulfilled all the requirements. In noting its design (Fig. 1) it will be observed that it covers the full width of the sash channel or runway, and raised corrugations reduce the side friction surface to a minimum. The rib, which fills a groove 3/8-in. deep in the sash, is thickest at its apex, thus

reducing friction in the groove and, what is more important, filling the width of the groove even if the frame shrinks away from the sash. This rib acts as the sole guide of the sash, the stops being set so as not to come in contact with it. In fact, it would be possible to dispense with the stops altogether when these strips are used.

The metal used is zinc, which is largely self-lubricating and completely weather-resisting, and in contact with wood, shows no perceptible wear. The male and female members used at the meeting rail are of peculiar design (Fig. 2), the rounded edge of the male interlocking with the rounded hook. The manufacturers of the weather strip guarantee that when subjected to usual and ordinary usage it will wear as long as the sash.

The writer has consulted with and has been advised by many of the most prominent heating and ventilating engineers in this country, and all agree with him that it is not only feasible but practical to make a substantial reduction in heating surfaces where strips of this character are used.

It would seem inconsistent to expend large sums to make walls weather-tight and leave 3 or 4 square inches of opening about each window. This opening must, perforce, remain if sash and frame are of wood and sash is to be movable, as at least 1-16-in. clearance all round is necessary to provide for shrinkage and swelling under different weather conditions. When a metal weather strip with projecting ribs is introduced, the problem is solved. The window can then be opened at will, but when shut, it is shut completely.

It is the writer's intention to make further tests along this line in conjunction with several engineers. In these an attempt will be made to arrive at actual leakages in buildings under varying conditions of sash, velocity and direction of wind, etc.

It should not be lost sight of that a heating plant, in order to be efficient, should meet the extreme of unfavorable conditions. In calculating these conditions, which are, at best, uncertain, the engineer must use his judgment, or, in other words, he must guess. The one who guesses right oftenest reaps the largest measure of success.

Any device which helps to reduce this uncertainty is a distinct benefit to the engineer, as well as the building owner. For the benefit of the latter it has many times been demonstrated that the reduction in cost of the heating plant practically offsets the cost of a weather strip that will meet the requirements above set forth.

H. W. WHITTEN.

New York, Dec. 6, 1907.

The Weather During November

BOSTON

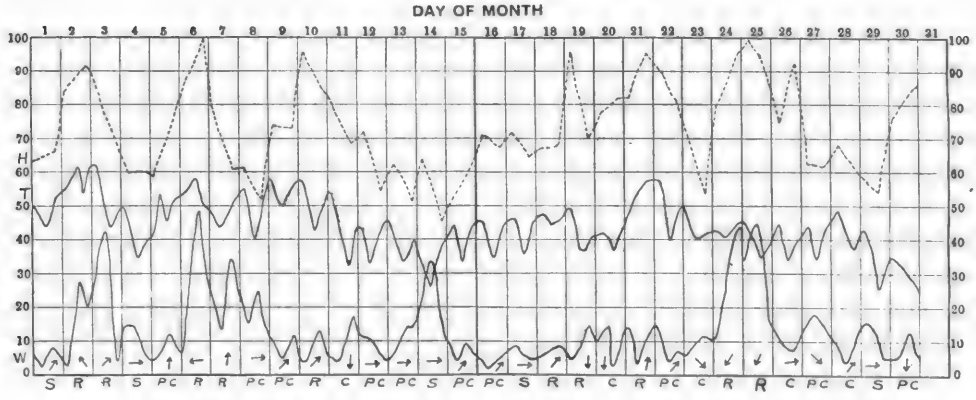
In Boston the highest temperature recorded was 61° on the 3d, and the lowest, 25° on the 30th. The greatest daily range was 21° on the 5th, and the least daily range, 5° on the 24th. The mean temperature for the month was 43°, 2° above the mean of this month for 37 years. There was 6.02 inches of rain, 2.94 inches falling on the 24th and 25th. The total rainfall was above the average. The prevailing direction of the wind was west, and the total movement, 7,659 miles; average hourly velocity, 10.6 miles; maximum velocity for 5 minutes, 48 miles from the northeast on the 6th. There were 5 clear days, 11 days partly cloudy, 14 cloudy and 10 rainy.

NEW YORK

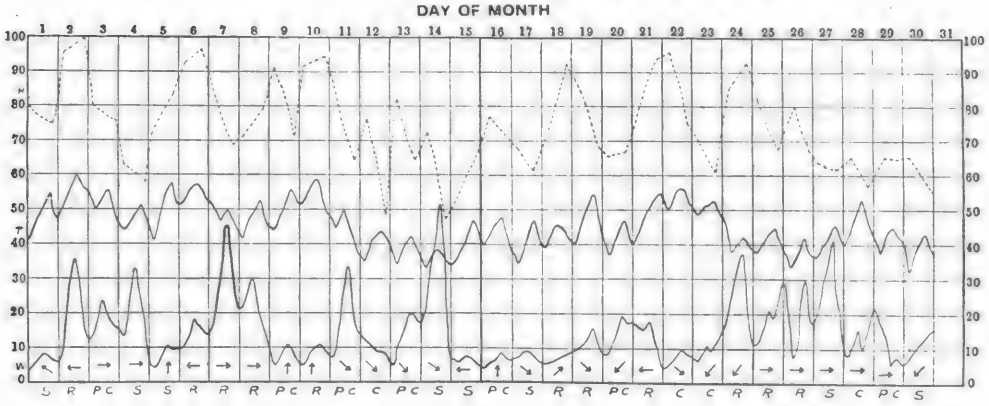
In New York the highest temperature was 60° on the 2d, and the lowest, 33° on the 30th. The greatest daily range was 17°, and the least daily range, 4° on the 23d. The mean temperature for the month was 45°, which is 1° lower than the normal temperature for 37 years. The total rainfall for the month was 5.05 inches, more than the average. The greatest rainfall in any one day was 1.90 inches on the 6th-7th; prevailing direction of the wind, west; total movement, 8,699 miles; average hourly velocity, 12.1 miles; maximum velocity for 5 minutes, 52 miles per hour from the northwest on the 14th. There were 11 rainy days, 8 clear days, 9 days partly cloudy and 13 cloudy.

CHICAGO

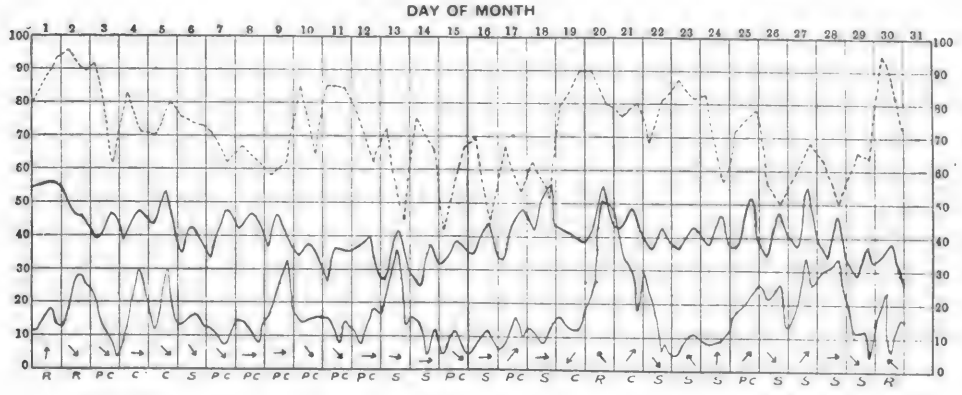
In Chicago the mercury touched 56° on the 27th, and 25° on the 14th. The greatest daily range was 17° on the 27th, and the least daily range, 4° on the 1st. The mean temperature for the month was 41°, 2° above the normal temperature for 37 years. During the month 1.92 inches of rain fell, which is over half an inch below the average. There were also 3



RECORD OF THE WEATHER IN BOSTON FOR NOVEMBER, 1907



RECORD OF THE WEATHER IN NEW YORK FOR NOVEMBER, 1907



RECORD OF THE WEATHER IN CHICAGO FOR NOVEMBER, 1907

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Upper line indicates temperature in degrees Fahr.
Dotted line indicates relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.
Lower line indicates velocity of wind in miles per hour
Arrows fly with prevailing direction of wind
S—Clear. PC—Partly Cloudy. C—Cloudy. R—Rain

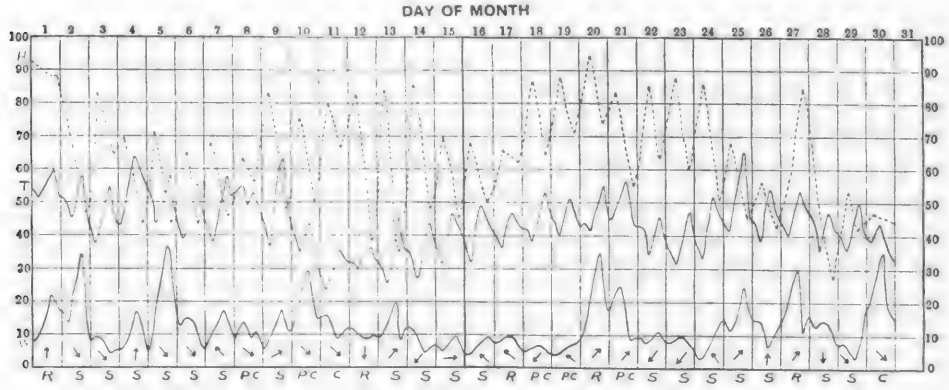
inches of snow. The greatest precipitation in any one day was 0.99 inch on the 20th; prevailing direction of the wind, northwest; total movement, 10,520 miles; average hourly velocity, 15 miles; maximum velocity for 5 minutes, 52 miles from the southwest on the 20th. There were 12 clear days, 10 partly cloudy, 8 cloudy and 4 rainy.

ST. LOUIS

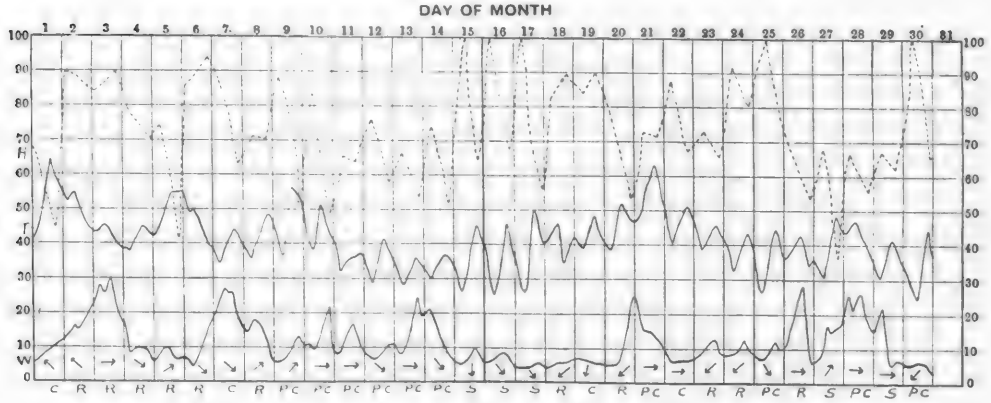
The highest temperature recorded for the month was 66° on the 25th, and the lowest, 23° on the 11th. The greatest daily range was 25° on the 9th, and the least daily range, 8° on the 12th. The mean temperature for the month was 44°, 1° below the average for 35 years. The total rainfall was 1.89 inches. The greatest rainfall in any one day occurred on the 1st, when 0.96 inch were recorded. The average rainfall for 37 years is 2.83 inches. A snowfall of 0.1 inch was recorded. The prevailing direction of the wind was northwest; total movement, 7,487 miles; average hourly velocity, 10.4 miles; maximum velocity for 5 minutes, 38 miles per hour from the northwest on the 5th. There were 18 clear days, 5 partly cloudy, 7 cloudy and 5 rainy.

PITTSBURG

Pittsburg showed a high temperature of 64° on the 1st, and a low record of 24° on the 30th. The greatest daily range was 24° on the 17th, and the least daily range, 6° on the 11th. The mean temperature for the month, 41°, was 2° below the average for 37 years. Total rainfall for the month, 1.59 inches; snowfall, 0.4 inch; greatest precipitation in any one day, 0.60 inch on the 2d-3d. The average precipitation for 37 years is 2.42 inches. Prevailing direction of wind, west; total movement, 7,788 miles; average hourly velocity, 10.8 miles; maximum velocity for 5 minutes, 43 miles per hour from the northwest on the 7th. There were 5 clear days, 11 partly cloudy, 14 cloudy and 10 on which rain fell.



RECORD OF THE WEATHER IN ST. LOUIS FOR NOVEMBER, 1907



RECORD OF THE WEATHER IN PITTSBURG FOR NOVEMBER, 1907

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Upper line indicates temperature in degrees Fahr.
Dotted line indicates relative humidity in percentage from readings taken at 8 a. m. and 8 p. m.
Lower line indicates velocity of wind in miles per hour
Arrows fly with prevailing direction of wind.
S—Clear. PC—Partly Cloudy. C—Cloudy. R—Rain.

American Society of Mechanical Engineers

The twenty-eighth annual meeting of the American Society of Mechanical Engineers was held in the United Engineering Building, New York, December 3-6, last. It was the first annual meeting of the Society to be held in its luxurious new home, and the appointments and facilities of the spacious building were enjoyed to the utmost.

The programme included an address by the retiring president, Prof. F. R. Hutton, on "The Mechanical Engineers and the Function of the Engineering Society;" a symposium on gas power; an illustrated lecture by Mr. F. E. Ives on "Color Photography;" a symposium on foundry practice; two papers on the subject of superheated steam; a paper by Prof. W. F. M. Goss on "Power Transmission by Friction Driving," and a paper by Prof. J. H. Wallace on "Cylinder Port Velocities." We present herewith abstracts of some of the papers of special interest to the heating and ventilating engineer, while elsewhere in this issue will be found the paper of W. J. Keep and Emmet Dwyer describing the new foundry building of the Michigan Stove Company.

Following are the newly-elected officers who will serve during the ensuing year: President, M. L. Holman, St. Louis, Mo.; vice-presidents (elected for two years), L. T. Breckenridge, Arthur West and Fred. J. Miller; managers (elected for two years), W. L. Abbott, H. B. Stott and A. B. Humphreys; treasurer, William H. Wiley, New York; secretary, Calvin W. Rice, New York.

MOLDING SAND, BY A. E. OUTERBRIDGE, JR., PHILADELPHIA, PA.

Original investigations in testing and mixing molding sand are described, and practical results given whereby "toughness" and "porosity" of sand are greatly increased by simple mechanical treatment. Sand test bars were made under uniform conditions of pressure, dampness and quantity of material; these were slowly pushed over the edge of a smooth metal plate until they broke, when the amount of "overhang" was measured.

By passing molding sand once through a centrifugal mixing machine the toughness was increased 75%.

Illustrations show treated and untreated sand test bar, also centrifugal mixing machines used in preparing molding and core sand.

A VOLUMETRIC STUDY OF CAST IRON, BY HENRY M. LANE, CLEVELAND, O.

This paper deals with some interesting discoveries regarding the volume which the impurities in cast iron occupy, and offers an explanation for many peculiarities long known to exist in iron castings. It also deals with malleable castings and compares gray iron castings with wrought iron. Diagrams are used to illustrate the relationship between the proportions of the elements by weight and by volume.

THE FOUNDRY CUPOLA AND IRON MIXTURES, BY W. J. KEEP, DETROIT, MICH.

This paper gives some foundry experiences and endeavors to aid the founder in the more economical operation of his plant. While the operation of a cupola will make or lose more money than any other part of a foundry equipment, yet this is due to the skill of the operator more than to any proportion of the cupola.

Regarding iron mixtures, it seems difficult for the founder to understand the relation between chemical and physical composition and the effect of slow or rapid cooling.

This paper treats of this and tells how to calculate mixtures for various qualities of castings, also how to regulate the percentage of silicon by mechanical analysis.

FOUNDRY BLOWER PRACTICE, BY W. B. SNOW, BOSTON, MASS.

In the fan type, pressure depends upon revolutions; volume at constant speed varies with outlet area; greatest power is required when resistance is least. In the rotary type pressure depends upon resistance; within limits, volume is independent of outlet area; power increases with resistance. Local conditions largely determine relative superiority. In best cupola practice air supply is less than chemical requirements. Tests show great and unnecessary variety in blast pressures. Pressure and melting rates should be as low, and cupola diameters as great as practical considerations will allow. Power expenditure is then the least.

THE SPECIFIC HEAT OF SUPERHEATED STEAM, BY PROF. C. C. THOMAS, CORNELL UNIVERSITY

This paper presents in graphical form the results of an extensive series of experiments made in such manner that the accuracy of the work is established. The work extended over three years of continuous research, and the various series of experiments were so planned that they check each other, and this serves to verify the accuracy of the results. The method used included heating the steam by means of the electric current.

The development and final form of apparatus are fully described, as are the methods of making observations. The results are given in such form as to afford means of comparing them with results obtained by various other experimentors in the same line. A Mollier-Heat-diagram has been prepared by the author and included with the paper, giving the results of the investigation in convenient form for immediate use by engineers.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Annual meeting of the society, January 21, 22 and 23, 1908, in the United Engineering Societies' building, 29 West Thirty-ninth street, New York. Secretary, William M. Mackay, 116 Beekman street, New York.

SESSIONS

Tuesday, Jan. 21, 2 P M., 8 P. M.
Wednesday, Jan. 22, 2 P. M.
Thursday, Jan. 23, 10:30 A. M., 2 P. M.
Wednesday, Jan. 22, 8:30 P. M., banquet at New Grand Hotel.

Secretary William M. Mackay has sent to the members a membership ballot containing the names of thirty candidates, two-thirds of whom are Western heating engineers. With the election of these candidates, the society will show one of the largest increases in its membership in several years.

Ballot for New Officers

The following nominations have been made by the nominating committee and the result of the balloting will be announced on the opening night of the annual meeting, January 21:

For president, James Mackay, Chicago; T. J. Waters, Chicago.

For first vice-president, Jas. D. Hoffman, Lafayette, Ind.; George Mehring, Chicago.

For second vice-president, B. F. Stangland, New York; J. J. Blackmore, New York.

For secretary, W. M. Mackay, New York; H. J. Barron, New York.

For treasurer, U. G. Scollay, Brooklyn, N. Y.; L. J. Wing, New York.

For directors, C. B. J. Snyder, New York; R. C. Carpenter, Ithaca, N. Y.; W. N. Haden, Trowbridge, England; Aug. Kehm, Chicago; Frank N. Chew, New York; B. S. Harrison, New York; Jas. H. Brady, Kansas City, Mo.; Bert C. Davis, Kansas City, Mo.; John F. Hale, Chicago; and W. H. McKiever, New York. (Five directors to be chosen.)

The following have been appointed an entertainment committee for the annual meeting: J. A. Donnelly, chairman; J. A. Connolly, Thomas Barwick, George D. Hoffman and H. C. Mallory, all of New York.

The December meeting of the Illinois chapter was held December 9 in the rooms of the Western Society of Engineers, Monadnock Block, Chicago. Mr. Paul P. Bird, head of the department for the prevention of smoke in the city of Chicago, continued his discussion of "Smoke Prevention and the City Ordinances Relating to Same."

American Society of Refrigerating Engineers

The third annual meeting was held in the Engineering Societies' Building, 29 West Thirty-ninth street, New York, December 2 and 3, 1907, with President D. S. Jacobus in the chair. Among the papers on the programme were the following: "Cold Storage by Means of Ice," Madison Cooper; "The Automatic Refrigerating Machine," Van Rensselaer H. Greene; "Fireproof Cold Storage Warehouse Construction," John E. Starr; "Comparison of Bids for Ice Making and Refrigerating Machinery," Thomas Shipley, and "Heat Transfer in Coolers and Condensers of the Double Pipe Plan," R. L. Shipman.

New officers were elected for the ensuing year as follows: President, Edgar Penney; vice-president, Karl Vesterdahl; treasurer, Walter C. Reid; directors, Ttomas Shipley, Karl Wegemann and John C. Waite.

Following the professional sessions a dinner was held at the Hotel Victoria, New York, which was also the headquarters of the society during the meeting.

Trade Literature

The 1908 Types of Ideal Sectional Boilers are displayed in a new catalogue issued by the American Radiator Co., Chicago. Exhaustive tests of the new types show that with the improved construction a notably greater evaporative power may be obtained and it is intended at the close of the present season to retire the 18-, 21-, 24-, 30- and old 36-inch sectional boilers in favor of the new heaters. A record of tests, showing the efficiency of the new constructions, has been published and may be had on application. The tests have shown, among other things, that 1 sq. ft. of direct heating surface will evaporate as much water as 4 sq. ft. of the average flue surface. In connection with the statement that 1 sq. ft. of heating surface in a boiler has no greater power of heat transmission now than it had 40 years ago, the tests have shown that the position of the heating surface may be so arranged as to quadruple the rate of transmission.

Included in the catalogue are photographic views of all of the new types, also price lists, measurements, etc., and graded ratings of Ideal steam and water boilers.

In the company's guarantee notice it is stated that the boilers are guaranteed only to the extent of furnishing new castings for any found defective in manufacture. Pp. 24. Size 7¾x10 in.

Direct-Current Electric Motors, for operating ventilating fans and blowers, manufactured by the Sprague Electric Co., New York, are the subject of a recently-issued bulletin, Bulletin No. 310,

showing these motors connected to various types of fans, blowers and exhausters, together with separate views of the round type and multipolar motors. Illustrations are also given of some of the more prominent buildings, the ventilating apparatus in which is driven by Sprague electric motors, including photographs of typical installations. A feature of the round type motors is their compactness, as a result of which they require little space, whether they are belted or direct-connected to the ventilating apparatus. The multipolar direct-current motors are used for driving fans and blowers which require motors of larger capacity than the round type. These motors are made in nine different sizes of frames, ranging from 10 to 95 H. P. for standard slow speeds and from 15 to 105 H. P. for standard moderate speeds. Pp. 28, 8x10½ in.

Potter Mesh Separator is called to the attention of the trade through a unique and attractive calendar of colored celluloid, so arranged as to be suitable for any year from 1906 to 1916, inclusive. The calendar is not only a handy one for daily use, but is of service for quickly determining past days and dates. Copies of the calendar may be had by addressing the Potter Separator Co., Newburgh, N. Y.

Pipe Covering Pointers are contained in a circular issued by the H. W. Johns-Manville Co., New York, calling attention to the Asbesto-Sponge Felted Covering, including price list. Another recent publication of this company is a catalogue describing the Morris Metallic Packing for which the H. W. Johns-Manville Co. is the selling agent. This packing is designed especially for Corliss valve stems and all piston rods, steam turbines, and for hydraulic, air, gas, ammonia and vacuum service. It is applied to the stem of the valve, on the part usually covered by the old gland, and therefore can be applied without truing up the stem where scored by soft packings. It will hold any steam pressure.

Pierce Herald, for October, 1907, contains an illustrated article on the Touraine, Jr., boiler, showing its adaptability for heating dwellings. Among the other contents are Thompson's rule for figuring radiation and points on good coverings for insulating pipes and boilers. The publication will be sent to anyone in the trade asking for it. The publishers are the Pierce, Butler & Pierce Manufacturing Co., Syracuse, N. Y.

J-M Asbestos Lead Joint Runner, for making lead joints in cast-iron gas and water pipe; Asbestos papers, including wall board, building felts, etc., with price list; also J-M insulated arc lamp hangers, and Noark fuse plugs, "all in one piece," are among the important products of the H. W. Johns-Manville Co., New York, featured in recently-issued circulars. "How to Get More Heat with Less Coal" is the title of an additional circular describing the Asbestocel corrugated fireproof paper for covering hot air furnaces and furnace pipes.

Tests of Vento Heaters for Fan Systems of Heating

Exhaustive tests of the Vento cast iron heaters, manufactured by the American Radiator Co., Chicago, for use in fan systems of heating, have been conducted at the company's Bond plant in Buffalo, N. Y., during the past month. The tests were made under the supervision of Prof. J. H. Kinealy, of St. Louis, in the presence of a notable group of heating and ventilating engineers. A special structure was built for the tests. Experiments were made with different numbers of sections, operating under various air velocities and located at different distances from the blower.

Among those present at the tests, in addition to Prof. Kinealy, were: James H. Davis, manager of the company's fan blast department; William Beck, architect of schools, Buffalo; A. A. Landon, general superintendent of the company's manufacturing department; Charles B. Thompson, engineer of the company's department of research; Frank G. Buckheit; Samuel Moore, manager of the Bond plant; Joseph H. Brady, chief engineer of the Board of Education of Kansas City, Mo.; Frank Whitelaw; Louis Bruch, advertising manager; Theodore Weinshank, of Indianapolis; W. W. Macon and Frank K. Chew, of the *Metal Worker*, New York; William Gregory; Edward Schofield, manager of the company's Buffalo branch; Prof. William Kent, of Syracuse University; and Isaac H. Francis, Jr., of Philadelphia.

Steel Tubular Pole for Singer Building, New York

John Simmons Co., of New York, has completed the erection of a 62-ft. steel tubular pole at the top of the new Singer Building, New York. The ball on top of the pole is just 674 feet above the sidewalk. This company is now equipped to produce tubular poles for use as masts or flag staffs and is prepared to submit estimates on poles 15 ft. to 150 ft. high. In the construction of these tubes, if, for instance, an 8-in. pipe is to be jointed to a 7-in. pipe, the square section is chamfered to a sharp edge. The 8-in. pipe is then heated and brought under dies in a steam hammer, where the cold 7-in. pipe is inserted, the 8-in. pipe drawn down, and then allowed to shrink. After cooling the bevel is caulked down with a pneumatic hand hammer to make an absolute moisture-proof contact, steel to

steel. The step from one size to another is thus a gradual and unnoticeable one, and sharp corners are obviated.

Publications Received

The Proceedings of the Twenty-fifth Annual Convention of the National Association of Master Plumbers, held at Louisville, Ky., June 25-27, 1907, has been received, and contains much matter of special interest, including a full report of the discussion over the much-talked-about "stamped order" resolution, which was pigeonholed by the convention. The proceedings contain also the full report of the plumbers' legislative committee, giving the laws and ordinances regarding plumbing in force in the various states and territories; also the recommendations and ensuing discussion of the committee engaged in an effort to standardize plumbing goods in general and ball cocks, basin cocks and bath cocks in particular.

New Book

"Water Supply," by F. E. Turneaure, is a new work on this subject published by the American School of Correspondence, Chicago, Ill. It is one of a series of 24 practical books on science, mechanics and engineering, and will be found of value to sanitary and water works engineers and all interested in public health. It covers the field of water supply and consumption, construction of wells, reservoirs, pipe lines, drainage systems, purification plants, etc. The text is fully illustrated by 40 engravings. Pp. 150. Size, 6½x9½ in. Price, $1.00.

Taylor Brothers Company in Important Deal

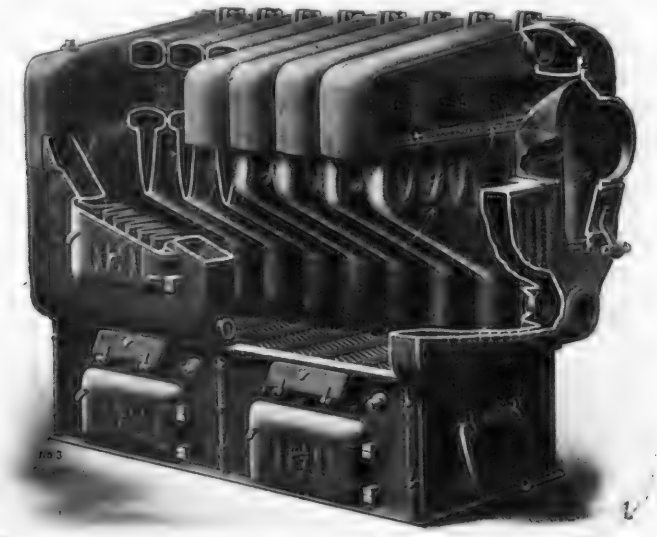
The news of the incorporation, in Rochester, of the Taylor Instrument Companies, with a capital stock of $535,000, marks the consummation of a deal whereby the firm of Taylor Brothers Company of Rochester becomes one of the largest manufacturers of thermometers, meterological and other instruments in the world.

The new corporation is the outgrowth of the thermometer business established in 1851 by George Taylor. In the early 70's George Taylor and Frank Taylor became associated under the name of Taylor Brothers.

Under this name the business was continued until 1890, when following the death of George Taylor, it was incorporated as Taylor Brothers Company.

Taylor Brothers Company has since acquired the business of the Hohmann & Maurer Mfg. Co., the Watertown Thermometer Co., the R. Hoehn Co., Short & Mason, Ltd., London, England, the H. & M. Automatic Regulator Co. and the American branch of the Cambridge Scientific Instrument Co., of Cambridge, England.

The directors of the new company are: G. Elbert Taylor, J. Merton Taylor, Frank Taylor, Edward Bausch, Henry W. Maurer, H. J. Winn, Isaac Mayer, M. H. VanBergh, John W. Taylor. Its officers are: G. Elbert Taylor, president; J. Merton Taylor, vice-president; Herbert J. Winn, treasurer; Henry W. Kimmel, secretary.



THE BERNHARD BOILER, WHICH HAS BEEN PURCHASED BY THE THATCHER FURNACE CO., OF NEW YORK, AND WILL BE MANUFACTURED AND SOLD HEREAFTER BY THAT FIRM

OBITUARY

John R. Reed

John R. Reed, since 1878 president of the H. B. Smith Co., Westfield, Mass., boiler and radiator manufacturers, died at his home in Westfield November 11, after a few days' illness. He was 75 years old. Mr. Reed was a man of unusual character, and he has left a deep impression of his personality not only in the business circles with which he was connected, but also on the community where he spent the greater part of his life. He is spoken of by a writer in the *Valley Echo*, of Westfield, Mass., as "a man of rare type—not only a modern Puritan, but, what is of greater import, a modernized Puritan," an estimate of the man justified by his long and useful life. Mr. Reed's integrity and ripened judgment made him a valuable adviser in association work, and he was always an influential factor in the shaping of trade policies in which he was interested.

Mr. Reed was born in Ware, Mass., in 1832, being descended from English stock. He was the son of a minister, the Rev. Augustus Reed. He spent three years of his youth on the sea, sailing over the North Pacific and Alaskan waters on whaling expeditions.

On his return, in 1859, he entered the employ of the H. B. Smith Company, with which firm he was connected continuously up to the time of his death. At the reorganization of the firm in 1878, Mr. Reed was elected president and general manager, and to him is largely due the growth of the business, which now employs 800 men and has a weekly payroll of $10,000.

Mr. Reed was for many years a deacon of the First Congregational Church of Westfield. He was also a trustee of the Westfield Academy and a director and member of the corporation of the Westfield Athenaeum, and an incorporator of the Westfield Y. M. C. A.

Mr. Reed was twice married. His first wife was Julia Priscilla Breckenridge, of Ware, and his second wife, Martha Huntington Dudman, of Yarmouth, N. S. He is survived by his widow and five children, Richard D. Reed, Miss Clara M. Reed, William B. Reed, Miss Edith H. Reed and Miss Susan M. Reed. Of his children, his son, Richard D. Reed, is prominently connected with the management of the H. B. Smith Company.

Professor Storm Bull

Storm Bull, professor of steam engineering in the Wisconsin State University at Madison, Wis., died at his home in Madison November 18 last of cancer. Professor Bull was a nephew of Ole Bull, the violinist. He was born in Norway in 1856 and was graduated from the Federal Polytechnic Institute in Zurich in 1877. He came to America in 1885, and was made professor of steam engineering at Wisconsin University in 1891, after having served as instructor there. He was mayor of Madison during 1901-1902. Professor Bull was a member of the American Society of Heating and Ventilating Engineers, and at the society's last meeting in Chicago in July he was present and took an active part in the discussions.

Thomas H. Williams

Thomas Hilton Williams, president of the A. A. Griffing Iron Co., Jersey City, N. J., whose death, October 19, was noted in our last issue, was born February 14, 1848, at Springfield, Mass., and early in life removed to Jersey City, N. J., where he subsequently became prominently identified with the iron and brass metal industries. He graduated from Packard's Business College of New York and, after a short experience in the banking business, became a partner in the E. A. Williams & Son Brass and Bell Foundry, of Jersey City. At the time of his death he was president of E. A. Williams & Son, Inc. Mr. Williams was perhaps best known to the trade through his long association with the A. A. Griffing Iron Co., makers of the Bundy radiators. He became an officer in this company at a time when the use of cast iron radiators for steam and hot water heating was in its infancy. To his efforts is due much of the development that has made this one of the leading lines of manufacture at the present day.

He was a member of the American Society of Mechanical Engineers, the Engineers Club' the Lawyers' Club of New York, the American Geographical Society of Washington, D. C., and the Carteret Club of Jersey City, N. J.

Mr. Williams is survived by his widow, Fannie Holden Williams; his son, Thomas Hilton Williams; and daughter, Vida Cook Williams.

India's Metallurgical Development

Consul E. H. Dennison writes as follows from Bombay on the new iron and steel mill for British India:

"A company has recently been formed in Bombay, with a capital of $7,500,000, for the purpose of constructing in India blast furnaces, open-hearth steel furnaces, rolling mills, coke ovens and other plant necessary for the manufacture of pig iron, steel rails, bars, plates, etc., and to acquire mining rights over very valuable and large deposits of iron ore. A site for the new works has been selected near Sini Junction on the Bengal-Nagpur Railway, where the three essentials—iron ore, coal and limestone—can be assembled at a low rate of transit. The enterprise is to be a distinctly Indian concern, the capital being Indian and the board of directors composed entirely of native Indians."

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THE HEATING AND VENTILATING MAGAZINE

VOL. IV., NO. 12 NEW YORK, DECEMBER, 1907 $1.00 a year, 10 cents a copy

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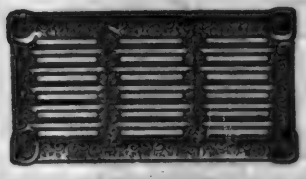

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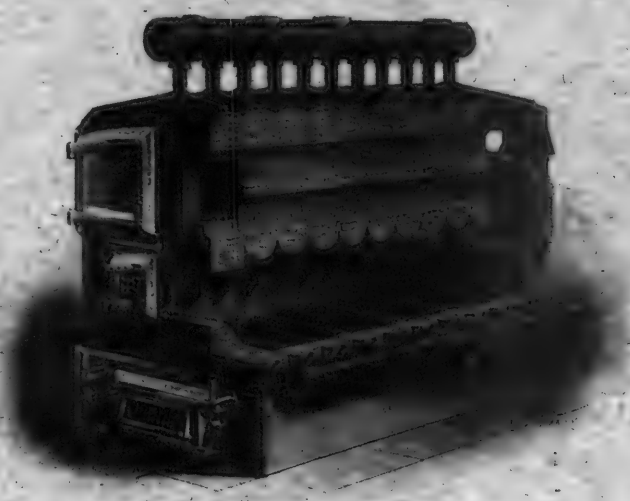

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THE HEATING AND VENTILATING MAGAZINE

VOL. IV No. 12

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TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes

Thatcher Furnace Co., New York, has purchased the patterns, etc., of the Bernhard boilers from the receivers of the Garwood Foundry & Machine Co., Garwood, N. J., and will add the boiler to its extensive line of heating apparatus. The company has engaged Mr. J. B. Bernhard, the inventor of the Bernhard boiler, as manager of its boiler manufacturing department. Creditors of the Garwood Foundry & Machine Co. were notified that an offer for the property of the company had been made (except cash and accounts and bills receivable), the terms being $5,000 in cash on delivery of title, $7,000 payable January 15, 1908, and $20,000 through the guarantee of the principal and accrued interest on the company's outstanding mortgage bonds. This offer was accepted and the Thatcher Furnace Company has taken over the plant as well as the patterns of the boiler.

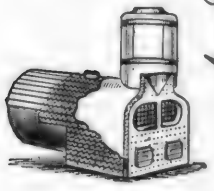
Frederick W. Smith has resigned as vice-president and manager of the United States Radiator Co. Dunkirk, N. Y.

Frank B. Barrett, New York, has been appointed manager of the boiler and radiator department of the Dimock & Fink Co., New York.

David M. Nesbit, of Ashwell & Nesbit, Ltd., London, England, who has been exhibiting the Nuvacuumette system of heating at the building of Kieley & Mueller, New York, sailed for England December 12 on the Celtic. A number of American heating engineers and manufacturers viewed the apparatus in operation, and it is expected that the system will shortly be placed on the market in this country.

Stoughton, Wis.—The new high school, which is approaching completion, will be heated by steam from the Stoughton water works, carried to the building through a tunnel.

TELEPHONE CALL 6097 FRANKLIN.



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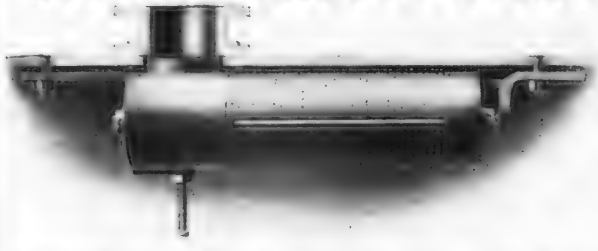

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Chicago Heat, Power & Refrigeration Co., Chicago, has completed its organization by the election of the following officers: President, William F. Brennan; vice-president, Joseph B. Fleming; secretary, Joseph P. Early; treasurer, Fred. W. Blocki; directors, the officers and Kurt Stoehr. The company is seeking a franchise from the city to furnish heat, power and refrigeration for all purposes.

Midland Supply Co., Davenport, Ia., succeeding the Davenport Heating & Plumbing Co., has leased from the Rock Island Railroad the property south and east of the freight depot, on which it will erect a two-story brick building. The company, which was recently reincorporated, will change from a retail to a wholesale heating and plumbing supply house. Officers: President, John Corry; vice-president, A. D. Hathaway; secretary, A. Roy Fuller; treasurer and general manager, Fred. Wernentin, Jr.

Kalamazoo, Mich.—The city council has granted Frank W. Armstrong a franchise for a central power and heating plant.

Pekin, Ill.—The Empire building will be heated with steam furnished by the Pekin Light, Heat & Power Co.

Hoffman Heater Co., Lorain, O., has declared a dividend of 20% on its outstanding stock. New officers and directors were elected as follows: President, B. F. Koch; vice-president, A. V. Hageman; secretary and treasurer, C. Nieding; C. F. Beutel and George F. Hess; manager, Thomas G. Chapman; superintendent, F. H. Oehlke.

Cheyenne, Wyo.—The town council has granted to Morris J. Hinchcliff, of Clinton, Ill., a 20-year franchise for a public heating plant, with the privilege of using the streets for steam mains. The franchise also gives him the right to manufacture and sell gas for lighting and heating purposes.

St. Petersburg (Russia) International Lighting and Heating Exhibition, including a display of kerosene, spirit and benzine heating apparatus, was opened in St. Petersburg, Russia, December 14, and will continue until February 14, 1908. It is being held under the auspices of the Imperial Russian Technical Society. The railway companies of Russia, France, Germany, Austria and Belgium have offered to transport unsold exhibits back from the exhibition free of charge.

R. T. Crane, president of the Crane Co., Chicago, was the principal speaker at the November meeting of the Chicago Trade Press Association. His subject was "Industrial Education."

Massachusetts Boiler Rules, revised as the result of a number of serious boiler explosions, have been issued by the State Boiler Inspection Department of Massachusetts. In addition to the requirements regarding maximum pressure on boilers, shearing strength of rivets, factors of safety and fusible plugs, which were referred to in the November issue of THE HEATING AND VENTILATING MAGAZINE, the requirements include also sections regarding sizes of rivets, maximum allowable strains on stays, tables of grate areas for safety valves, gauges, stop and check valves, damper regulators and provisions

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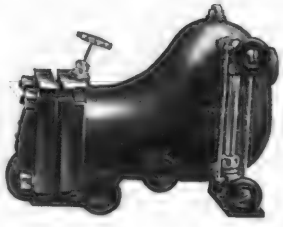

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for inspecting and testing. A complete set of the revised regulations may be had by addressing the State Boiler Inspection Department, Boston, Mass.

Clarence M. Woolley, president of the American Radiator Co., Chicago, has returned from a three-months' business trip to England, France and Germany.

Manufacturers' Notes

United States Boiler & Radiator Co., West Newton, Pa., is occupying temporarily the foundry and plant of the Standard Stove and Range Company, which has been in the hands of a receiver. The consideration was $14,000, which includes a $13,000 mortgage on the property of the defunct stove company. Contracts have been awarded for the erection of a new plant for the United States Boiler & Radiator Company to replace the plant recently destroyed by fire.

American Valve Co., Coxsackie, N. Y., has nearly completed the two-story brick addition to its plant.

Mahony Heating, Ventilating & Blower Co., Troy, N. Y., has taken over the boiler and furnace business of the Mahony Manufacturing Company.

H. W. Johns-Manville Company's plant at 914-918 North Broadway, St. Louis, Mo., was partially destroyed by fire November 9. The loss is estimated at $150,000, 85% of the stock being ruined. The building and contents were fully insured.

Fitzgibbons Boiler Co., Oswego, N. Y., is building a large addition to its factory.

Parr Regrinding Valve Co., Cleveland, O., recently organized, has elected the following officers: President, W. S. Parr; vice-president, C. A. Mattoon; secretary and treasurer, C. F. Haas. Directors: the officers and W. J. Boardman.

Quinn Supply Co., Kalamazoo, Mich., jobbers of pipe and fittings, has increased its capital stock from $15,000 to $75,000.

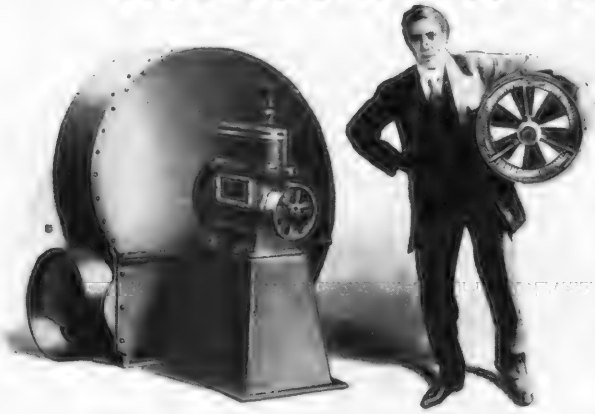
Louis Lipp Co., Cincinnati, O., manufacturers of plumbing supplies, suffered a $40,000 loss by fire at its plant November 20. The company announces that it will be only temporarily hampered in its deliveries.

Enameled Pipe & Engineering Co., Cleveland, O., which was recently incorporated for the manufacture of acid and rust proof vitreous enamel steel pipe and fittings, will build a new plant at Elyria, consisting at first of two buildings of steel and glass construction. President and general manager, R. F. Nailler. General offices of the company, Citizens' Building, Cleveland.

Business Changes

Woodlawn Plumbing & Heating Co., Seattle, Wash., has taken over the business of J. W. Rafferty, Green Lake, Wash.

WING'S TURBINE FAN SYSTEM
OF
MECHANICAL DRAFT



The Small Fan under the man's arm takes the place of the large blower and engine.

means guaranteed economy of fuel, increased boiler capacity, absolute simplicity.

First and operating costs less than any other system and equals the results of the best.

Requires no floor space and little attention.

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Mfrs. Wing's Disc Fans, Blowers and Exhaust Fans

Designers and Builders of Heating and Ventilating Systems

Ernshaw & Reed, Fredonia, N. Y., heating contractors, have opened a branch office at Dunkirk, N. Y.

James H. Munden & Sons, West Allegheny, Pa., have succeeded to the business of Munden & Addy. Mr. Addy retires and Mr. Munden's two sons, R. A. and J. M. Munden, have been taken into partnership. The firm will continue at the same location, 102 Erie street.

New Incorporations

Mayer Ice Machine & Engineering Co., Jersey City, N. J., capital $125,000, to manufacture machinery, pumps, pipes, etc. Incorporators: J. J. Mayer, F. W. Mayer and J. G. R. Wysser, Jr., all of West Hoboken, N. J.

Accessible Valve Co., Columbus, O., capital $5,000, to manufacture special valves for gas and water fittings. Incorporators: Walter Klie and F. D. Wollenweber.

Logansport Radiator Equipment Co., Logansport, Ind., capital $50,000, to manufacture heating specialties. Incorporators: George L. Morrow, A. B. Benson, J. F. Digan and John O'Donnell.

Threading Machine Co., Sandusky, O., capital $25,000, to manufacture a new pipe threading machine. The machine will be made at the plant of the Sandusky Foundry & Machine Co., in which the incorporators are also interested. Incorporators: R. E. Schuck, J. J. Dauch, W. H. Millspaugh, Sidney Frohman and George A. Blackford. President, Sidney Frohman; vice-president, William F. Seitz; secretary, R. D. Kunz; treasurer, Ed. Alslaetter. It is planned to place the new machine on the market by January 1, 1908.

Mobile Plumbing & Supply Co., Montgomery, Ala. Capital stock, $10,000.

Standard Plumbing Co., Seattle, Wash. Capital stock, $10,000. Incorporators: D. F. Kreader and Samuel Howe.

Holtje & Barker Plumbing & Heating Co., Great Neck, Long Island, N. Y. Capital stock, $10,000. Directors: John Holtje, F. B. Barker and John Gannon.

New England Iron Works Co., Boston, Mass., incorporated to deal in steam boilers and heating specialties. Incorporators: Peter B. Gaudet, Charles F. Koopman, Jr., and Sumner Robinson.

Mell Plumbing Co., Atlanta, Ga. Capital stock, $10,000. Incorporators: John Mell and others.

Franklin-Nelson Plumbing & Heating Co., Parkersburg, W. Va. Capital stock, $5,000.

J. G. Dombrower Corporation, Richmond, Va., capital $10,000, to engage in the heating and plumbing business.

Zinc-Coated Steel Slip Nipples

For Steam and Hot Water Radiators and House Heating Boilers

THE PRATT CHUCK CO., Frankfort, N.Y.

FREE SAMPLES furnished to interested parties

Jupiter Packing Co., Anderson, Ind., capital $10,000, to manufacture Jupiter metallic packing. Directors: D. E. Stanley, Albert Harper and Sparks L. Brooks.

E. A. Moody Co., New York, capital $10,000, to conduct a heating and plumbing business. Incorporators: Edwin A. Moody, Foster H. Pierce and Estelle E. Pearce, all of 54 West Twenty-fourth street, New York.

Globe Brass Mfg. Co., Cleveland, O., capital $50,000, to manufacture plumbers' brass goods. The company has taken space in a building at 418 Prospect avenue, S. W. President, Christian Bohn, of Bohn Bros. & Co., hardware dealers, Cleveland; secretary, E. H. Bohn. Other incorporators: F. C. C. Schaefer, William B. Bohn, Henry F. S. Schroeder and Henry F. Beek.

Knox-Gilchrist Co., capital $2,500, to conduct a heating and plumbing business. Incorporators: Robert Knox, Margaret L. Knox and William J. Gilchrist.

New Firms

North Charleroi Plumbing Co., Lock No. 4, Pa., has engaged in the heating and plumbing business at that point.

Kern Plumbing Co., Kern, Cal., is a new firm of heating and plumbing contractors, composed of E. G. Norris and R. H. Ferguson.

John Redmond, St. Charles, Ill., has opened a new heating and plumbing business on West Main street, in that city.

Holyoke Supply Co., Holyoke, Mass., has been organized to deal in pipe supplies and also to carry on a steam contracting business. The company will also manufacture the Flynn steam fire engine heater. President, D. F. Moriarty; treasurer, L. D. Wright. S. H. Howland, of Oliver & Howland Co., of Worcester, is also among those interested in the new firm.

Kitson Light & Heat Co., Philadelphia, Pa., has engaged in the manufacture of plumbers' brass goods, which will be sold to the jobbing trade. The company's agent in New York is O. Chan Wells, 100 William street.

Business Chances

Grand Rapids, Mich.—The Board of Education will soon advertise for bids for the installation of a new heating and ventilating apparatus for the Coit Avenue School addition. The new building is to be finished by April 1.

Chicago, Ill.—A steam heating plant will be installed in the Spring City Hotel, Chicago, by the new owner, Victor C. Gardner.

UTILITY Exhaust Muffler, Oil Separator, Return Tank Pump Governor and Feed Water Heater

UTILITY Vertical Steam Receiver and Separator

UTILITY Pump Governor Valve and Head

UTILITY Pump Governor Valve

UTILITY Steam Separator

UTILITY Pump Governor

UTILITY Exhaust Head

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542-544 WEST BROADWAY, NEW YORK

Calumet, Mich.—A new heating plant is to be installed in the Red Jacket Congregational Church.

Elkhorn, Wis.—The State Board of Control has suggested to the County Commissioners that a steam heating plant be installed at the county farm and that the buildings be lighted by electricity. The improvements will cost about $15,000.

Elder Grove, Wis.—The school boards have decided to install ventilating systems in many of the school buildings in the vicinity of Elder Grove.

Madison, Wis.—The State Capitol Commission is planning to have the new $500,000 power and heating plant completed by the fall of 1908.

Wyocena, Wis.—The committee on building the new hospital at Wyocena has been voted an additional appropriation of $2,000 for installing a heating and ventilating plant and electric lighting equipment.

Cincinnati, O.—Sealed proposals will be received at the office of the Board of County Commissioners until Friday, December 27, 1907, for remodeling the steam heating system for the Ohio National Guard armory building, Freeman avenue, Cincinnati. Samuel Hannaford & Sons, Cincinnati, are the architects.

Hampton, Va.—Plans have been prepared for the construction of the United States National Home for Disabled Volunteer Soldiers at Hampton. There will be three barracks, a mess hall and hospital wing. John Calvin Stevens and John Howard Stevens, Portland, Me., are the architects, and Arthur B. Fels, Portland, Me., is the consulting engineer for the heating, ventilating and power equipment.

Contracts Awarded

J. C. Bixby & Son Co., Omaha, Neb., heating and plumbing residence of F. S. Knapp at 1330 South Thirty-fifth street.

Neil & Co., Superior, Wis., heating and plumbing normal school addition in Milwaukee.

Huffman-Conklin Co., Columbus, O., heating and plumbing new building on East Main street for the Lutheran Book Concern.

Goemans Bros., De Pere, Wis., hot air heating system for church at Preble.

H. A. McIntyre, Crystal Falls, Mich., heating county poor house for $900.

Orr & Graves, Sioux City, Ia., were the lowest bidders, at $1,097, for the heating plant for the Dwight building.

Northern Heating & Electric Co., St. Paul, Minn., were awarded a year's contract to heat the Audittorium for the present season.

Cleveland Steam Fitting & Supply Co., Cleveland, O., hot water heating system for the residence of W. E. Wall, at 1873 East Ninetieth street.

Bump & McCabe, Petoskey, Mich., new hot water heating plant for the county jail and sheriff's residence to cost about $1,000.

Ben Benson, Willmar, Minn., heating new school building at Svea, Minn.

Mueller Bros., Gaylord, Minn., steam heating Sibley House.

Wyckoff-Lloyd Co., Springfield, Mass., heating and plumbing Springfield Country Club at West Springfield.

Minot Plumbing Co., Minot, N. D., heating and plumbing the new Optic building.

Hilborn & Faulkner, Cincinnati, O., heating new public school at Lamont for $3,000.

Anderson-Darragh Co., Pittsburg, Pa., heating 17-story warehouse for E. M. Meyer.

Jacob Reudi, St. Louis, Mo., heating and plumbing apartment building, being built by himself.

C. O. LeClair, Uniontown, Pa., heating

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department store for the Tower Hill Coal & Coke Co.

McGinness-Smith Co., Pittsburg, Pa., hot water heating system for Aged People's Home.

Bartley-Kennedy Co., Pittsburg, Pa., heating system for combination church and apartment building in lower Allegheny.

Iron City Heating Co., Pittsburg, Pa., steam heating 17-story Keenan building. The Neilson Co., of Pittsburg, has the plumbing contract.

Latrobe Foundry & Machine Co., Latrobe, Pa., heating business block at Barnesboro.

Heckler Bros., Sheridanville, Pa., hot air heating system for the First M. E. Church at Glassport, Pa.; also the new Grace Reformed Church at Sharpsville. Heckler gas furnaces will be installed.

Baker, Smith & Co., Pittsburg, Pa., heating St. Kiernan's Roman Catholic Church.

Masters & Co., New Kensington, Pa., heating Marini business and apartment building.

Lewis & Kitchen, Kansas City, Mo., hot air heating system for First Christian Church at Independence, Mo.

Kupferle Mfg. Co., Evanston, Ill., steam heating five-story mercantile building at that place.

McMahon & Co., Kansas City, Mo., heating contract for the nine-story building of Montgomery, Ward & Co.

Elliott & Barry Engineering Co., Evanston, Ill., steam heating mercantile building occupied by the Erker Bros. Optical Co.

Monier & Mahaney, Biddeford, Me., heating and plumbing Central Fire Station being built by the city of Biddeford.

N. J. Smith, Worcester, Mass., steam heating State Armory on Grove street. J. T. Cahill & Sons have the plumbing contract. Both contracts total $6,818.

Benn Nodeau, Presque Isle, heating new Carnegie Library. Norwall vacuum valves will be installed.

H. M. Shaw & Sons, Caribou, Me., heating, plumbing and gas fitting St. Mary's College at Van Buren, Me.

M. D. Holmes & Son, Worcester, Mass., hot water heating system for large envelope factory in that city.

James H. McPartland, Houlton, Me., heating and plumbing Central Fire Station.

Butler Plumbing & Heating Co., Erie, Pa., vacuum heating system for St. Stanislaus's Church, parochial school and parsonage.

BURT S. HARRISON'S
HEAT LOSS CHARTS

¶ Enlarged copies of the Heat Loss Charts published in the November, 1907, issue of The Heating and Ventilating Magazine. Chart 1, measuring **11x21** inches; Chart 2, measuring **21x30** inches.

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Robert W. Kyle Co., Wheeling, W. Va., steam heating and plumbing new business and apartment building for J. H. Davidson.

C. Wessendorf, Memphis, Tenn., hot air heating system for college at Arlington, Tenn.; also heating Block building in Memphis.

Frederick A. Tyler, Albany, N. Y., hot water heating Salvation Army barracks at Oneida.

Andrews Heating Co., Minneapolis, Minn., steam heating Plymouth Congregational Church of Dodgerville, Wis.

J. E. Wells Co., Portage, Wis., steam heating Eulberg Block, that place.

Will Boone, Calumet, Mich., heating new Quello building on Fifth street.

Townsend & Colling, Winchester, Ill., heating system in Presbyterian Church, that place.

Bayley Manufacturing Co., Milwaukee, Wis., heating and ventilating plant for the G. T. R. R.'s shops at Battle Creek, Mich.

Newell Bros., Los Angeles, Cal., steam heating and plumbing in Kerckhoff's ten-story office building, Main and Sixth streets. Also heating and plumbing Eshman's seven-story building, that place.

Johnson & Beck, Topeka, Kan., contract for compressed air, steam and water pipes in the Santa Fé round-houses at Trinidad, Col.; Chanute and Argentine, Kan., and Shopton, Ia.; also heating the Chanute round-houses and shop buildings, and replacing the old heating plant of the Santa Fé depot and hotel building at Dodge City with a high pressure boiler and vacuum heating system.

B. L. Hall & Co., Benton Harbor, Mich., steam heating the O. B. Hipp building in that place.

Baker-Niebuhr Co., La Crosse, Wis., heating and plumbing High School building in Galesville, Wis.

Norfolk Plumbing & Heating Co., Norfolk, Neb., heating Gallagher Block in O'Neill, Neb.

A. L. Bennett, Preston, Minn., steam heating county poor house.

American Warming & Ventilating Co., Pittsburg, Pa., heating new High School at South Sharon, Pa., for $12,735.

Samuel A. Esswein Heating & Plumbing Co., Columbus, O., heating and plumbing $40,000 residence of Frank Huber in that city.

Garrett & Cone, Salem, O., heating town hall.

English & Dolliver, Lewiston, Me., heating St. Mary's Parochial School at Bath, Me.

L. H. Skiff, Brookings, S. D., heating Hotel Tremont, Elkton, S. D.

Sioux Hardware & Construction Co., Dell Rapids S. D., heating and plumbing the new building of the Dells Hotel Co.

Ahern & McCoy, Fond du Lac, Wis., heating and plumbing warehouse of the Hill Bros. and DeWitt Co. for $2,500.

Aberdeen Heating & Plumbing Co., Aberdeen, S. D., heating and plumbing the Indian School at Sisseton, S. D.

B. Mackensie, Greensboro, N. C., heating Peoples' Bank & Trust building at Salisbury, N. C.

Balmat & Brayton, Carthage, N. Y., steam heating addition to High School at that place.

Noll Bros., Poughkeepsie, N. Y., heating and plumbing new building for the fire department.

Best Manufacturing Co., Pittsburg, Pa., contract for piping to be installed in the furnaces and mills of the new $75,000,000 plant of the United States Steel Corporation at Gary, Ind. The contract amounts to over $1,000,000.

Duncan Sinclair, Brownsville, Pa., steam heating and plumbing the Monongahela National Bank's new office building at Monongahela, Pa.

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steam heating ten-story building at Stockton street and Union Square avenue.

F. A. Bradley, Buffalo, N. Y., steam heating and plumbing systems for the new plant of the Buffalo Copper & Brass Co.

James Hunter Heating & Contracting Co., Albany, N. Y., steam heating First National Bank of Albany. M. Delehanty's Sons, of Albany, have the plumbing contract.

J. H. Ruckel & Son, Buffalo, N. Y., fan heating system for the Independent Order of Odd Fellows' new building at Herkimer and West Ferry streets.

Seattle Heating & Plumbing Co., Seattle, Wash., steam heating State Normal School at Ellensburg; also State Soldiers' Home at Orling, and the State Deaf and Dumb School at Vancouver.

Finn Engineering Co., Altoona, Pa., heating and plumbing Imperial Dry Goods Co.'s building at Eleventh avenue and Eleventh street, that city.

George Cook, Beaver, Pa., heating $15,000 Anderson block.

Edward Thierry, St. Louis, Mo., plumbing and heating $35,000 residence on Portland Place.

Star Furnace Co., St. Louis, Mo., heating five new residences on Westminster avenue.

John I. Dick, Scottdale, Pa., heating and plumbing apartment building in that city for C. M. Jarrett.

Cotter-McDonnell Plumbing & Heating Co., Kansas City, Mo., plumbing and steam heating two new engine houses, that city.

Cody & Shea, Peoria, Ill., remodelling heating system in the Municipal building, that city.

H. J. Morrison, Poplar Bluff, Mo., plumbing and heating new Christian Church, that city.

City Plumbing Co., East St. Louis, steam heating Christian Science Church, that city.

A. Burlingame & Co., Worcester, Mass., heating Palmer Carpet Mills.

Geo. Faiszt, Grayville, Ill., heating Court House at Albion, Ill.

Fargo Plumbing & Heating Co., Fargo, N. D., pneumatic water supply system for the county hospital building, to cost $1,820. Water will be pumped from the river by a 5-H. P. gasoline engine into two tanks holding 3,000 gallons each. The pneumatic system will give a 40-lb. pressure, forcing the water wherever needed. A standpipe will also be erected and in case of fire a 100-lb. pressure will be available.

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[708 A]

Martin & Wigman, Green Bay, Wis., heating High School at Galesville, Ill.

C. E. Pratt & Sons, Hastings, Neb., steam heating Madgett Block, that place.

Frank Morrison, Bloomington, Ill., steam heating new Y. M. C. A. building at that place for $5,000.

Braman, Dow & Co., Worcester, Mass., boilers and piping for three apartment buildings on Hamilton street.

Engleby & Bro. Co., Roanoke, Va., heating large store building for the Exchange Lumber Co.; also heating the Melrose and Gilmore Avenue School buildings. This company is also installing a Broomell vapor heating system in the $75,000 residence of J. B. Fishburne at Roanoke.

Arthur Freer, Winnebago, Minn., steam heating plant for Parker College.

C. A. Richardson, Tacoma, Wash., heating new high school building.

Schirmer Bros., Chisholm, Minn., heating and plumbing high school building.

Tacoma Plumbing and Heating Co., Tacoma, Wash., heating Rogers school building.

Norfolk Plumbing and Heating Co., Norfolk, Neb., heating and plumbing school building.

Cuddy-Cavanagh Co., New Ulm, Minn., heating and plumbing new Court House at Jackson.

Richardson & Clement, Boston, Mass., steam heating residence of Robert Walker in Newton, Mass.

Heckler Bros., Sheridanville, Pa., hot air heating First M. E. Church at Glassport, Pa.

P. W. Barton, Everett, Wash., heating and plumbing new buildings at Tullaip Reservation.

Illinois Plumbing & Heating Co., heating and plumbing new cottages at the Illinois Soldiers' and Sailors' Home at Quincy.

Thos. E. Hoye Co., Milwaukee, Wis., heating system for Frank Day Hotel, West Bend; Milwaukee Novelty Dye Works; Domestic Science Hall at Milwaukee Downer College, and a central heating plant for the West Bend Electric & Lighting Co.

M. F. McDonald, Boston, Mass., alterations to heating plant of fire station on Chester Hill avenue, Brighton.

M. Isbister Plumbing & Heating Co., Spokane, Wash., hot water heating Wellington apartments; also a $4,000 contract

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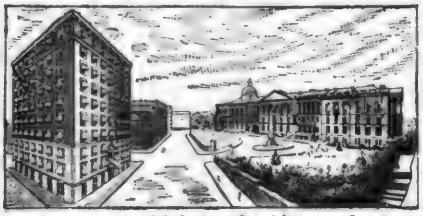

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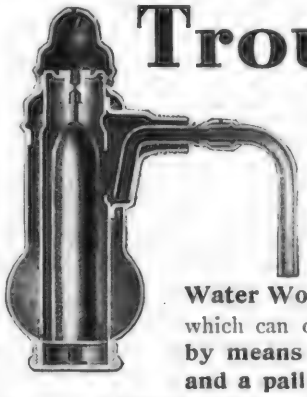

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W. D. Allen, Seattle, Wash., vacuum heating State Reform School at Chehalis, Wash.; also a vacuum system in Standard Furniture Co.'s new building.

U. J. Griffith Heating Co., Spokane, Wash., heating Peyton Block, Bancroft & Emerson Schools and the Deaconess Hospital in Spokane, and a new school building at Rathburn, Idaho.

Inland Heating & Ventilating Co., Spokane, Wash., steam heating Northwestern Business College and Albi building in Spokane, and the Coeur d'Alene Lutheran Church at Coeur d'Alene, Idaho.

A. B. Franklin & Co., Boston, Mass., heating and ventilating new addition to the Boston Mechanics' Arts High School.

Laskey & McMurrer, Boston, Mass., heating new fire station at Revere, Mass., for $1,354.

Graeber Bros. Lawrence, Kan., heating plant at Fort Sam Houston, Tex., to cost $40,000; also plumbing and heating officers' quarters at Fort Riley, Kan., for $12,680.

Buell Bros., Fulton, N. Y., plumbing and steam heating new business block of J. B. Birdcall.

Wicks, Hughes & Co., Utica, N. Y., fan heating and ventilating new High School at Ilion, and steam heating new school building at Oriskany, N. Y.

Olean Plumbing & Heating Co., Olean, N. Y., plumbing, heating and lighting systems in the $200,000 addition to St. Elizabeth's Convent at Allegany, N. Y.

Hopson & Chapin Mfg. Co., New London, Conn., steam heating new annex to the Waukegan Hotel at Norwich, Conn.

Johnson & Beck, Topeka, Kan., plumbing and heating new six-story bank building in Topeka for $11,000.

Edward P. Bates, Syracuse, N. Y., high pressure piping and steam heating in Onondaga Pottery Co.'s new building and new Herald building.

Isaac Coffin Co., Boston, Mass., steam heating 18-family apartment at Newton Centre; new Nurses' Home at Natick Hospital; also new three-story building at St. Mary's Convent, Cambridge, Mass.

Ingalls & Kendricken, Boston, Mass., hot water heating Dorntee Casket Co.'s building.

Wollauer & Dutcher, Seneca Falls, N. Y., steam heating new No. 1 Engine House.

Howley & Bergen, Seneca Falls, N. Y., steam heating and high pressure piping in Glenn Wagon Works' new factory.

Hobart Willis, Minneapolis, Minn., heating new Roddy building.

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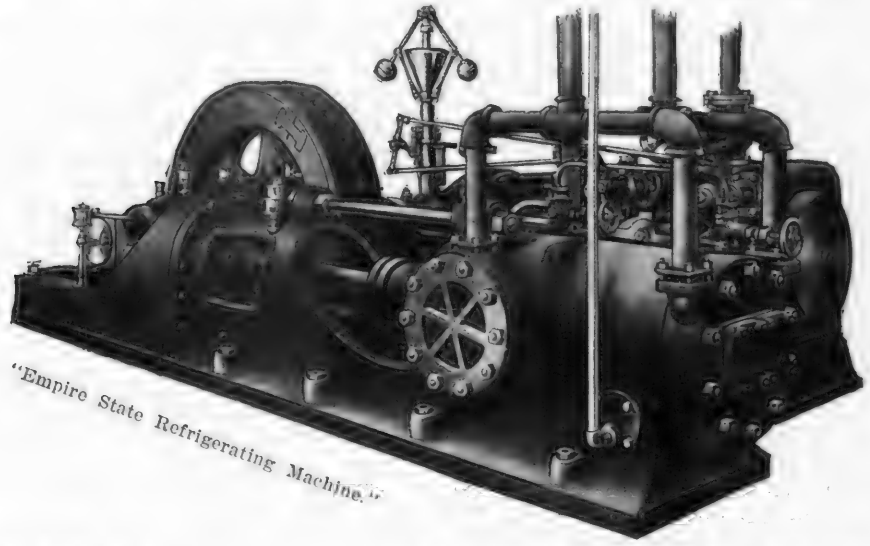

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Thos. E. Hoye Heating Co., Milwaukee, Wis., heating $125,000 six-story office building at Green Bay for Minehan Bros.

Frontier Plumbing & Heating Co., Buffalo, N. Y., steam heating Buffalo Copper & Brass Co.'s new mill.

Campbell & Lewis, Watertown, N. Y., heating the new State Street High School with a fan system; also steam heating new Engine House No. 4.

Ingalls & Kendricken, Boston, Mass., steam heating new Dunbar Hall at Phillips' Exeter Academy, Exeter, N. H.

W. A. Bowers Heating Co., Milwaukee, Wis., vacuum heating system for the Berger Bedding Co.'s new factory; also new factory of the Smith-Post Co. and the Dutcher Co.'s entire plant, all in Milwaukee.

Bayley Heating Co., Milwaukee, Wis., heating remodeled building for McGreal Bros. in that city.

Frank Morrison, Bloomington, Ill., steam heating new Y. M. C. A. building at that place.

Robins & Gamwell, Pittsfield, Mass., heating new Armory building at that place.

Ruhaak & Lackman, Pekin, Ill., heating large school house at Princeville.

C. Dwyer, Amsterdam, N. Y., heating and plumbing Faith Knitting Co.'s mills in Troy, N. Y.

Eureka Heating & Ventilating Co., Saginaw, Mich., heating new Valley Telephone building.

C. Wulf & Co., Sturgeon Bay, Wis., steam heating Joseph Babler's new hotel at Maplewood and new bank building at Sawyer, Wis.

Adolph Kern, of New York, incinerating plant for the street department of Cambridge, Mass., to cost $40,000.

W. F. Rutter & Co., Lawrence, Mass., heating new dye house and new office building for the Washington Mills; also addition to Smith & Dore factory in that city.

Bruce Bros., Fort Smith, Ark., plumbing and heating $50,000 Kennedy building in that place.

M. B. Sanders, Little Rock, Ark., heating new City Hall; Central and Stanley flats, and J. B. Spern & Co.'s store-house, the latter at Pine Bluff, Ark.

Frontier Plumbing & Heating Co., Buffalo, N. Y., steam heating new Doctors' Studio Club in that city.

James Hay Co., Allegheny, Pa., heating J. O. McCurdy's business and apartment building at Oakmont, Pa.

Bolger & Murphy, Waterbury, Conn., hot water heating new Casey Block in that place.

Long & Cross, Eugene, Ore., heating new Kline building at Corvallis.

C. A. Carlson, Frederick, Wis., hot

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water heating system for First National Bank building at that place.

H. W. Hoyt Co., Danbury, Conn., hot water heating system for the Groveland Hotel; steam heating Peix & McLahlan's hat factory; drying room for the Peck Fur Co., and a sprinkling system for the Danbury Hat Co.

J. M. Hasley, Anaconda, Mont., plumbing and heating new parochial school, that place.

A. F. Russell & Co., Seattle, Wash., plumbing and heating $200,000 mansion on Orbas Island, Puget Sound.

Moxee Hardware Co., North Yakima, Wash., heating and plumbing Yakima County Court House; also Toppenish Hotel at Lake Toppenish, Wash.

Rautman Plumbing & Heating Co., Seattle, Wash., plumbing and heating new Washington Hotel, that place.

Robert Brown, Norwich, Conn., heating and plumbing new car barns at Greenville, Conn.

Carr & Co., Collins, Miss., heating new Court House for $1,797.

J. J. Hurley, Somerville, Mass., heating and ventilating Sanford Hanscom School addition for $1,475.

Augusta Plumbing & Heating Co., Staunton, Va., heating and plumbing J. H. Neese's four-story hotel at Waynesboro.

A. L. Moulton, Fort Williams, Me., heating barrack building at Fort McKinley.

C. H. Norton, Mariette, Wis., heating, ventilating and plumbing High School at Ishpeming, Mich.

Manuel-Smith Heating & Ventilating Co,. Minneapolis, Minn., heating school building at Mapleton, Minn.

S. H. Scott, McKees Rocks, Pa., heating and plumbing business and apartment building for Joseph Greenburger.

F. X. Brunelle, Worcester, Mass., steam heating new convent at Wauregan, Conn.

J. A. Devaney & Co., Hastings, Minn., heating and plumbing men's cottage for the insane at Hastings.

John Gubbins, Elgin, Ill., steam heating residence of Ed. Shurtleff, Speaker of the Illinois House of Representatives.

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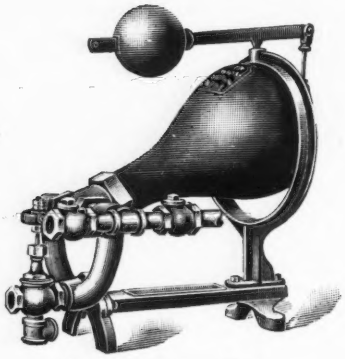

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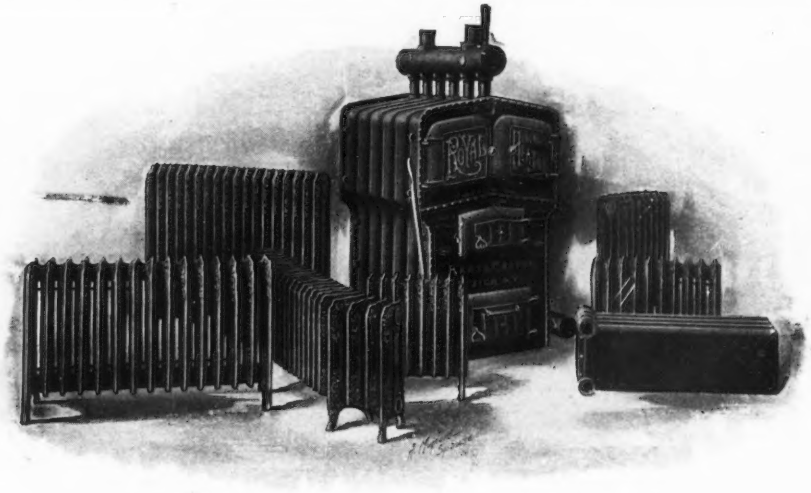

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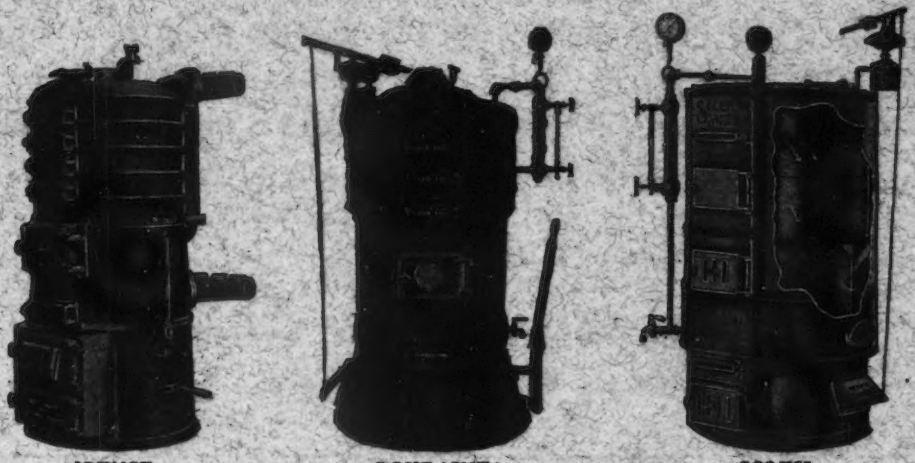

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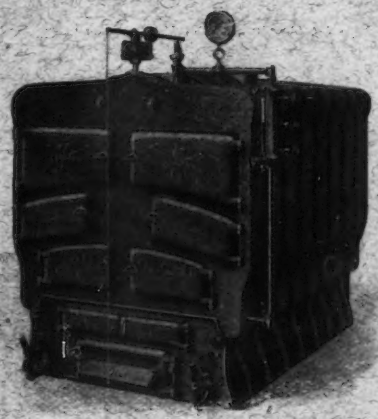

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